Forestry

DEC 18 1931

VETERINARY MEDICINE

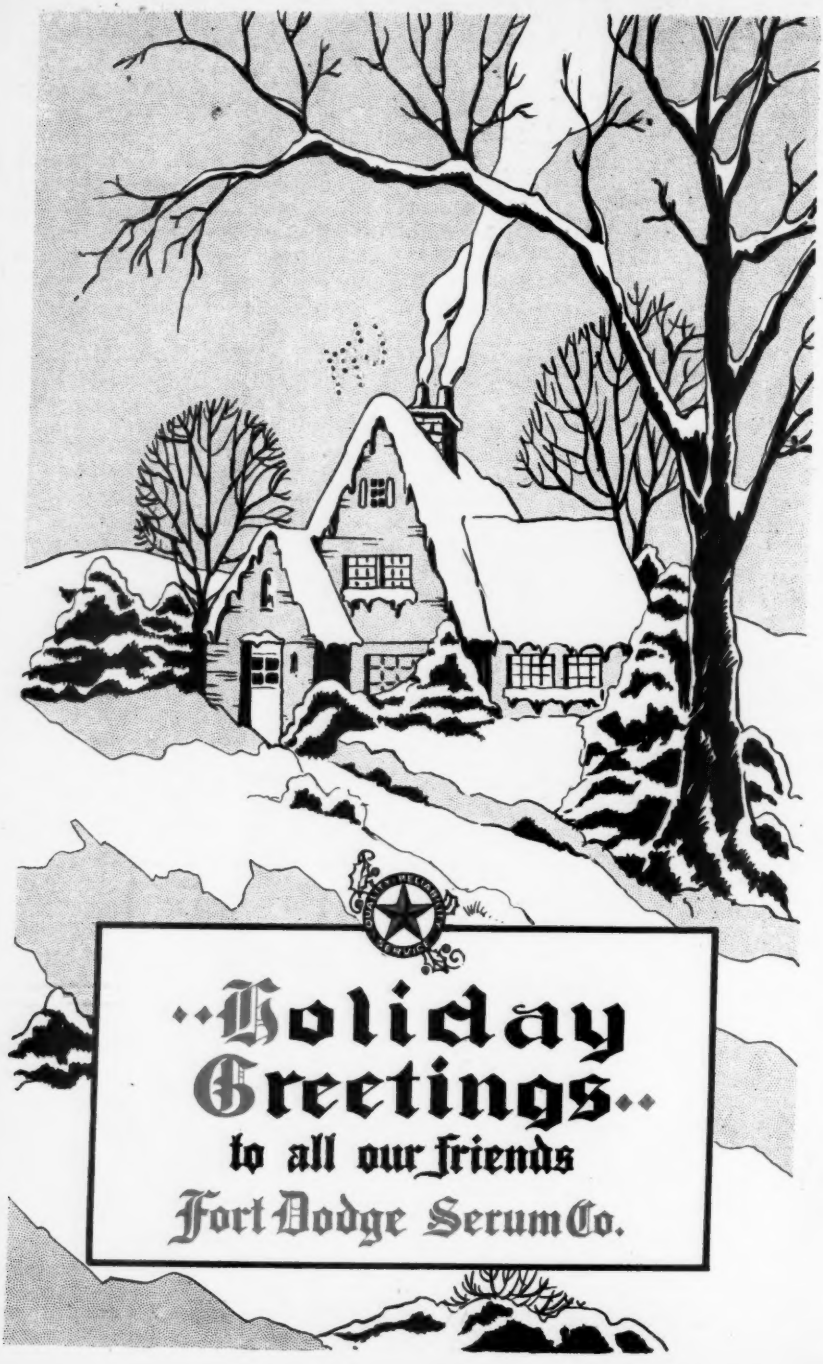
January, 1932

Contents

Treatment for Gastrophilus spp. . . . 4
The Veterinarian as a Municipal Food Inspector. . . . 6
Swine Surgery 8
Saving the Vaccination Fee. . . . 12
So-called Nutritional Anemia of Pigs. . . . 13
Post-Vaccination Troubles of Swine. . . . 16
Some Problems in Poultry Disease Control. . . . 19
Parasites a Probable Cause of Colic in the Horse. . . . 22
Pyrethrum and Its Uses in Veterinary Medicine. . . . 23
Formic Acid in Respiratory Disease. . . . 24
Three Pathological Conditions Affecting Ewes. . . . 26
Recent Advancement in Our Knowledge of Poultry Parasitism. . . . 30
Bacteriophage Ineffective in Pullorum Disease. . . . 34
Vitamines in Animal Nutrition. . . . 35
Epidural Pernocton Anesthesia in Dogs. . . . 36
Pigeon "Milk" 37
Cause and Prevention of Osteomalacia. . . . 38
Coccidiosis in Cattle. . . . 38
A Vaccine for Papillomatosis in Cattle. . . . 39
Treatment of Metritis. . . . 39
Bacterial Flora of the Equine Eye. . . . 40
Clarification Reaction for Bang's Disease. . . . 40
Oral Administration of Bacterins. . . . 41
Effects of the Calcium Level on Behavior of Cattle. . . . 41
Rickets, Tetany and Nymphomania in Cattle. . . . 42
Filter-passing Properties of Tubercle Bacilli. . . . 43
Vitamine A Deficiency in Cattle. . . . 43
The Production of Vomiting in Cattle. . . . 44

No. 1
VOL. XXVII

75 E. Wacker Drive
Chicago, U. S. A.


Holiday
Greetings
to all our friends
Fort Dodge Serum Co.

Forestry
Paxon

Veterinary Medicine

Registered in U. S. Patent Office

VOL. XXVII JANUARY, 1932 No. 1

Published Monthly by the Veterinary Magazine Corporation
75 East Wacker Drive, Chicago, Ill., U. S. A.
$4.00 a Year

Entered as second-class matter Nov. 8, 1920, at the post office at Chicago, Ill., under the Act of Mar. 3, 1879.
Entered as second-class matter under the title of American Journal of Veterinary Medicine, July 19, 1910, at Chicago, Illinois, under Act of March 3, 1879.

Copyrighted 1931, by Veterinary Magazine Corporation.
All matter appearing in this publication is covered by copyright, and no part of it may be reproduced without permission. Permission will be granted on request for the reproduction of anything in the columns of VETERINARY MEDICINE if the purpose of the reproduction is unobjectionable. Where there is any doubt as to the propriety of reproduction, the wishes of the author will be consulted.

D. M. Campbell, Editor A. T. Kinsley, Associate Editor

Thomasen (in Denmark) examined, serologically, the blood of 272 persons whose occupations brought them into intimate contact with cattle. Of 65 veterinarians in rural practice 61 (94%) showed positive reactions for *Br. abortus*. A class of veterinary students gave no positive reactions. Another class (of 18) were examined five months after leaving school and 15 (83%) reacted positively. Another class examined a year after leaving school gave similar results. Those giving negative reactions were not handling cattle. Of 16 bacteriologist working with Brucella 10 (63%) gave positive reactions. Of 21 cattle attendants on farms 13 (62%) gave positive reactions. Among 20 milkmaids only one showed a positive reaction. Five of 25 butchers (20%) gave positive reactions. Veterinary inspectors at abattoirs, farm owners and farm laborers showed varying percentages of positive reactions. Milk had no proved connection with reactions. Since undulant fever rarely correlates with the titer of the serum, the usual strains of Brucella are presumably not pathogenic for man. A check of 61 healthy persons whose occupations did not bring them into contact with cattle gave no positive reactions. The serological tests included both the agglutination and the complement fixation tests. The results of the latter test were far more frequently positive than of the former.

Tests of the efficiency of cinchona in the control of avian coccidiosis failed to give evidence of any benefit, according to Rebrassier and Bent.

Sawyer and Hamilton report that of 45,000 birds vaccinated for the prevention of fowl pox, only 27 contracted the disease during the following fall and winter months.

Roberts and Card, in a study of the hereditary resistance of chickens to pullorum disease, found that there was a 67% survival among over 6,000 chickens from selected resistant stock and only 28% survival among control chickens.

In reporting the results of an experiment, Ackert states that they indicate that the resistance of growing chickens to *Ascaridia lineata* is lowered when fowls four to seven weeks of age are kept on a diet deficient in vitamin A for a period of five weeks.

Durant states that it is within only the last few years that leukemia in fowls has become known as a disease of economic importance in Missouri. It occurs in two common forms; acute which kills the bird in a few days, and chronic, in which the birds may live for several months. Three per cent of the birds examined at the Missouri Station are affected.

The size of cooling tank should be ample to provide space for three times the volume of water there is milk to be cooled. An eight gallon can replaces about 1.1 cubic feet of water. In an experiment, Doctor Prucha found that the utensils added 112 times as many germs to the milk as were added by farm factors. In his opinion too much stress has been put upon sanitary practices of minor importance and not enough attention given to cleaning and sterilizing the utensils.—*Illinois Health Quarterly.*

Some interesting information relative to the gestation period of cows and sows has been reported by Johansson of Sweden, as follows: (1) The average in 10,219 gestation periods of Swedish red and white cattle was 283.7 days. In Swedish cow testing associations, parturition before a 250 day gestation period is considered an abortion and on this basis 5.5% of the 10,219 gestation periods ended in abortion; (2) the average in 1,423 gestation periods of sows was 114.3 days. The period was slightly longer in old than in young sows.—*Exp. Sta. Rec.* 64-1.

The cause of 90% of the diseases of little pigs, according to Hustede, is as follows: 70% were due to diplo-streptococci, 10% to paratyphoid, 5% to *B. coli,* and 5% to swine plague and cholera. An autogenous herd bacterin was found to be of value in controlling little pig infections. Housing and diet may be important predisposing factors. These findings of Hustede are probably based on the results of investigations in a restricted area or relatively small district. The percentages of different infections may vary somewhat in other districts. The high percentage of prevalence of streptococcic infection reported by Hustede is quite striking and perhaps is worthy of serious consideration. During the last few years pleomorphic streptococci have been found to be associated with disorders in swine in the corn belt of the United States.—(Bio. Abst. 7946.)

A ration containing 9% cotton seed meal can be fed with safety to swine for an indefinite period, according to Hale of the Texas Experiment Station. A ration containing only 9% of cotton seed meal is deficient in protein. This can be corrected by the addition of 4% of tankage.—*Tex. Bul.* 410.

Nutrition experts and health workers almost universally agree that an abundance of milk in the diet, especially of children, is essential if the highest degree of health possible is attained. The usual recommended quantity of milks is one quart for children and at least one pint for adults each day. The present rate of consumption the country over is less than half the recommended amount.—*Illinois Health Quarterly.*

An investigation in Wisconsin showed that the average dairy farmer works 67 hours per week in summer and 62 hours per week in winter. The Sunday work in summer amounted to 5 hours daily and in winter to 6.5 hours. Dairy farmers who used tractors worked slightly longer hours than those who did not use tractors, but they cultivated 17 more acres of crops and milked four more cows than the non-tractor farmers.

Man is one of the few animals that can adapt themselves to the cold arctic and torrid tropical zones of the earth. He can live one year in the arctic circle and the next in the tropics, or any place between these two climatic extremes. He has a body machinery that can adapt itself to tremendous variations in environment. This has been made possible by developing specialized accessory machinery. Man can insulate his body with clothing in the arctic zone, but he must still breathe the sub-zero air. He must depend upon his body machinery to throw off heat into an oven-like air in the tropics. Man has developed a coordinating and interacting type of body organ function not approached by any other organism.—*Illinois Health Quarterly.*

Sanitation of milk should start the instant it leaves the cow's udder. As produced by the normal, healthy cow, milk is reasonably free of germs and the few present are harmless, if not allowed to multiply appreciably. —*Illinois Health Quarterly.*

Colostrum milk may cause digestive disturbances when fed to babies or invalids and therefore milk drawn 15 days before or five days after calving should not be put in the supply intended for human consumption.—*Illinois Health Quarterly.*

Of 182 pigs, that were the progeny of one boar and nine sows that were thought to possess natural immunity to hog cholera, 161 or 88.5% died of cholera when injected with a known virulent virus. This experiment was conducted by Lambert, Murray and Shearer.—Bio. Abst. 24994.

Cottonseed meal poisoning may occur in lambs that are fed a pound of the meal for from 60 to 75 days, according to Cox. The symptoms manifested consist of inappetence, depression, continually lying down and getting up, bloating, thumps and rapid shrinkage. The post mortem lesions are gas in small intestine, serum in abdominal cavity, bile bladder distinded, congestion and inflammation of the abomasal mucosa.—New Mexico Exp. Station, Bulletin 179.

At no time has the advancement of knowledge concerning infectious abortion of cattle and swine been needed more than it is today. A great deal of experimental work has already been done on this disease by the Bureau of Animal Industry, both in independent investigation and in co-operative work with eight state universities and experimentations. At the Eleventh International Veterinary Congress at London last summer, a resolution was adopted calling attention to the need for scientific investigation of this disease in all civilized countries with a view to gaining more definite knowledge regarding its control, its immunology, and the relation of the disease to undulant fever in man.—John R. Mohler.

The advent of milk recording (test associations) has probably not been altogether a blessing, inasmuch as forced milk production is yearly producing more difficulties in breeding.—J. Quinlan.

Overfeeding and lack of exercise are important causes of infertility. Obesity is incompatable with fertility. By improper feeding it may be said that the breeder produces a champion at the expense of her fertility.—J. Quinlan.

One type of diphtheroid bacteria, the *Cornyebacterium murisepticum,* has a predilection for endothelial cells. It is highly pathogenic for mice. The bacteria are engulfed by the endothelial cells. Whether the endothelial cells are a defense mechanism or the microbes are pathogens of endothelium has not been determined. — *Bio. abstract* 17358.

Bang's disease is receiving major attention by investigators and control authorities. The *B. alkaligines* (the cause of Bang's disease) has been reported, apparently, as a pathogen, in horses and chickens, as well as in cattle, swine, goats and the human. It has also been reported by Mallman of Michigan, that there is an interagglutinability of members of the Brucella and Pasteurella groups of bacteria; that is, the serum from an animal that has been injected with organisms that produce hemorrhagic septicemia, will agglutinate the *B. alkaligines,* and serum from an animal that has been injected with organisms that produce Bang's disease, will agglutinate the *B. bipolaris.* If the serum from animals that have been infected with the *B. bipolaris* will agglutinate the *B. alkaligines,* then the agglutination test for the detection of Bang's disease is of questionable value. Is it advisable to base control of Bang's disease on the agglutination test?

Treatment for Horse Bots, *Gastrophilus* spp.

By WILLARD H. WRIGHT, Washington, D. C.
Zoological Division, U. S. Bureau of Animal Industry

THE development of the horse bot-flies is an interesting example of adaptation to changing environmental conditions in Nature. It is not an idle speculation to assume that these Diptera at one time had a direct life history and that changing environmental conditions, particularly as regards temperature, forced them to alter their mode of development in order to avert extinction.

It is not possible to say whether the ancients were familiar with the horse bots but the species have been known to scientists for two hundred years or more. Linnaeus classified these flies in his *Systema Naturae* (1735). Bracy Clark published an extensive essay on the horse bots in 1815. That some pathogenicity was early associated with the presence of the bot-fly larvae in the stomach of the horse is evidenced by the recommendations of writers in the 18th century for various treatments for the removal of these parasites. Some of these prescriptions for the treatment of bots call for half an ounce or an ounce of tobacco in the horse's feed, aethiops mineral half an ounce a day in a bit of cordial or pectoral ball, or mercurial physic. Fessenden in 1820 recommended a number of treatments for the removal of bots but seems to have mounted to the height of therapeutic empiricism in the following statement:

> "But the remedy on which we should rely with the most confidence is the following which we are told by a gentleman of undoubted veracity is an infallible remedy for bots. Apply spirits of turpentine to the outside of the breast and stomach of a horse and the bots will immediately let go their hold. Our informant assures us that he has seen horses which seemed to be in the last agonies with this distressing complaint, relieved instantly and apparently restored to full health in five minutes."

Treatment for the larvae of *Gastrophilus* spp., however, did not reach a rational basis until 1894, when Perronncito and Bosso introduced carbon disulphide as a remedy for the removal of these parasites. Since that time a number of writers have published their findings in regard to this treatment. Larisch (1916) reported that severe bot infestations were present in German army horses on the Russian front, and that during the period from February to May, 1916, 55 of 80 horses which died while under his supervision succumbed to infestations with bots. Treatment with carbon disulphide saved large numbers of animals and Larisch was never able to find bots in any of the treated animals which subsequently died of other conditions.

The carbon disulphide treatment was found efficacious also by Wessel, Taar, Bugarli, Cognesi, Hanke, Kröning, Nieder and others. Hall (1917) was the first in this country to give the drug critical test; he found that the treatment is 100 per cent effective for the removal of bots, apparently being equally effective against all three of the species occurring in the United States. Hall found also that oil of chenopodium and chloroform are ineffective for the removal of bots.

Hall, Smead and Wolf (1919) found that carbon disulphide is effective for the removal of bots and ascarids. They reported that one 6-dram dose of carbon disulphide is as effective as two 4-dram doses or three 3-dram doses and that the single dose is to be preferred because the

gastric mucosa is subjected to less injury.

Hall and Avery (1919) found also that carbon disulphide is effective against bots when given in a single dose of 6 drams without purgation or followed by purgation several hours after administration. The administration of linseed oil with or immediately following carbon disulphide resulted in reduced efficacy for the drug.

Dove (1919) reported from fumigation tests on larvae in situ that young bots could be killed by carbon disulphide in 45 minutes while last-stage larvae required an exposure of almost 3½ hours, *Gastrophilus intestinalis* being more resistant than other species. Judging from results of the critical experiments cited above, carbon disulphide ordinarily remains in the stomach for a sufficient length of time to kill all bots.

Dr. Paul C. Underwood of the Zoological Division has carried out *in vitro* tests with *Gastrophilus* larvae attached in situ on the walls of the stomach. Among the drugs used by him were carbon disulphide, tetrachlorethylene, n-butylidene chloride, propylene chloride, 2-chlorpentane, 3-chlorpentane, n-butyl chloride, secondary butyl chloride and tetrachlorethane. In these tests, carbon disulphide showed the greatest lethal action; tetrachlorethylene ranked next but the other compounds were ineffective.

Hall (1921) found carbon tetrachloride in critical tests upon two horses to be 24 per cent and 25 per cent, respectively, effective for the removal of bots. Hall reported also that mixtures of carbon tetrachloride and carbon disulphide possess a lower efficacy for the removal of bots than does carbon disulphide alone. Schlingman (1926) in critical experiments upon two horses found that tetrachlorethylene in a dose of 0.066cc per kilogram of body weight removed 77.8% of the bots from one animal, and that the drug in a dose of 0.15cc per kilogram, removed 43.75% of the bots from the second animal. Raffensperger in a paper not yet published finds that tetrachlorethylene is from 50% to 75% effective for the removal of bots.

It will be seen that at the present time, carbon disulphide is the most effective of the remedies for the removal of bots from the horse which have been reported on in critical tests. The present recommendations for the use of this treatment are as follows: The horse should be fasted for 18 to 24 hours, and carbon disulphide administered in capsule or by stomach tube, in a dose of six fluid drams (24cc) for a 1,000-pound animal. Feed should be withheld for four to five hours after treatment. No purgative is needed; oils are contraindicated. The bots may pass for 17 days or longer.

In connection with the efficacy of carbon disulphide against bots and ascarids, it is of interest to note that Wright, Bozievich and Underwood (1931) found this drug, when preceded by gastric lavage with an alkaline solution, to be effective also for the destruction of *Habronema muscae* in the stomach of the horse. There is reason to believe that carbon disulphide is equally effective against H. *microstoma;* in the experiments cited, the drug failed to destroy H. *megastoma* in stomach tumors.

The carbon disulphide treatment is not without its objectious as deaths have been reported both from inhalation of the drug due to breaking of capsules in the mouth and in cases where there was no such inhalation. However, there have been few reports of reactions following the widespread use of the treatment in bot-fly campaigns in states of the Middle West and in most cases the administration of the drug is not following by untoward results. The information available indicates that carbon disulphide is not contraindicated for use in pregnant mares; but the veterinarian should exercise judgment in considering any given case.

Carbon disulphide produces an area of redness and inflammation of the gastric mucosa and the mucosa of the upper duodenum. Wright, Bozievich and Underwood found that lesions in the stomachs

of animals killed 40 minutes to 1 hour and 45 minutes after treatment with carbon disulphide varied from a marked inflammation and blistering of the gastric mucosa to a slight inflammation and reddening of the mucosa of the stomach and upper duodenum. These workers found that preliminary gastric lavage with a 2% solution of sodium bicarbonate give some protection against the irritant action of carbon disulphide. The inflammation produced by carbon disulphide usually clears up within 10 days to two weeks.

New treatments recently placed on the market, including chlorinated carbon tetrachloride and mass capsules containing carbon disulphide incorporated in certain mineral bases, may offer safe and effective methods of treatment, but critical tests of these products have not been published. Such tests are essential for a sound judgment as to their value.

LITERATURE CITED

Dove, W. E. 1918. Some biological and control studies of *Gastrophilus haemorrhoidalis* and other bots of horses. Bul. 597, U. S. Dept. Agric., Apr. 9, 51 pp., figs. 1-4, pls. 1-5.

Fessenden, T. G. 1820 The husbandman and housewife. A collection of valuable recipes and directions relating to agriculture and domestic economy. 191 pp. Bellows Falls, Vermont.

Hall, M. C. 1917. Notes in regard to bots, *Gastrophilus* spp. *Jour. A. V. M. A.*, v. 52, n. s. v. 5 (2), Nov., pp. 177-184.

1921. Treatments for removing the gastro-intestinal parasites of horses, with some tests of carbon tetrachloride and of mixtures of carbon tetrachloride and carbon bisulphide. *North Am. Vet.*, v. 2 (11), Nov., pp. 512-524, 550.

———; & Avery L. 1919. The use of carbon bisulphid in infestations with bots, *Gastrophilus* spp. *Jour. A. V. M. A.*, v. 56, n. s., v. 9 (3), Dec., pp. 265-270.

———; Smead, M. J.; & Wolf, C. F. 1919. Studies on anthelmintics. 2. The anthelmintic and insecticidal value of carbon bisulphide against gastro-intestinal parasites of the horse. J. Am. Vet. M. Assn., v. 55, n. s., v. 8 (5), Aug., pp. 543-549.

Larisch, P. 1916. Die Bekämpfung der Gastruslarve. Ztschr. Veterinärk, Berlin, v. 28 (9), 4. Sept., pp. 292-301, figs. 1-4.

Perroncito, E.; & Bosso, G. 1894. Expériences sur la résistance vitale des larves d'oestre (*Gastrophilus equi*). *Rec. Méd. Vét.*, Paris, v. 71, 8 s. v. 1 (21), 15 Nov., pp. 657-665.

Schlingman, A. S. 1926. Miscellaneous tests of tetrachlorethylene, a new anthelmintic. *Jour. A. V. M. A.*, v. 68, n. s., v. 21 (6), Mar., pp. 741-754.

Wright, W. H.; Bozievich, J.; & Underwood, P. C. 1931. Critical experiments with carbon disulphide in the treatment of habronemiasis. Pp. 3-7 of reprint from *J. Roy. Army Vet. Corps*, v. 2 (2), Feb.

A Case of Swamp Fever.

THE VETERINARIAN AS A MUNICIPAL FOOD INSPECTOR*

The average span of life in ancient Egypt was about 30 years. Now, it is about 60 years. The greater part of this change has come about in the last 30 years. Improved sanitation has had much to do with lengthening the period of life. An important part of this better sanitation has comprised improved methods of producing and handling of food, for unwholesome food is the cause of both disease and death.

Legislation is necessary to carry out the purposes of food inspection, but legislation alone is by no means sufficient. The inspection is important, the inspector still more important.

A municipal or other food inspector needs to be patient, honest, impartial and qualified professionally. His decisions should be dependent upon scientific facts and not upon personal opinion. This excludes the layman as an inspector, for not being in possession of scientific facts upon which to base his decisions, however honest and impartial he may be, they cannot be based upon other than personal opinion.

Veterinarians Gaining in Meat Inspection—Losing in Milk Inspection

A questionnaire concerning food inspection was recently sent to 20 cities. Nineteen of them replied. These 19 cities employ 320 food inspectors. In milk inspection, 23 veterinary and 250 lay inspectors are employed. In meat inspection 60 veterinary and 85 lay inspectors are employed. Only one of the 19 cities employs no veterinarian.

The veterinary profession is established in meat inspection and is gaining ground; that is, veterinary meat inspectors in pro-

* Notes from an address by W. P. S. Hall, Toledo, Ohio, at the Eighth Annual Post-Graduate Short Course for Veterinarians, Michigan State College, East Lansing. January 26-30, 1931.

portion to the whole number of meat inspectors are increasing from year to year. This is not true, however, with regard to milk inspection. In this work the veterinary profession is making no progress and is probably losing ground due to lack of interest on the part of the individual and our schools.

Municipal meat and milk inspection differs very greatly in different cities. Recently dealers in a city having a meat and milk inspection ordinance applied for permission to sell meat and milk in Toledo, and as is required by the city ordinance, an investigation of their meat and milk inspection was made to determine if the products met the standard laid down for such foods in Toledo.

Worse Than No Inspection

The conditions found were almost unbelievable. The pasteurizer in the plant of the dealer wishing to supply milk to Toledo was one of the oldest type. There was no recording thermometer in the plant and no information as to the temperature at which the milk was passing through the pasteurizer, and no one in the plant knew how long it was held in the pasteurizer or for how long a period it was supposed to be heated or at what temperature other than an approximation.

Parts of the pasteurizer were apparently never washed thoroughly and all of it was in a condition of filth that would have made the best of milk unfit for use after passing through it. The milk inspector was a layman appointed for political considerations. He hadn't the slightest information about the scientific requirements of milk production and milk handling.

Veterinary Inspector Who Failed

The same city has a meat inspection law and the meat inspector is a veterinary practitioner devoting only a part of his time to meat inspection. An investigation at the slaughter house showed a number of carcasses of hogs and cattle stamped but the inspector had not seen the animals slaughtered nor did not make it a practice to see them slaughtered. At the time of my visit to this plant, the offal from these animals had been thrown in a tank, all together and even had the meat inspector been disposed to dig through the tank and had found diseased viscera, there would have been no way of telling to which animal it belonged and no recourse except to condemn all carcasses or to condemn none of them. It is not difficult to surmise what would be done.

This illustration is cited to show that being a veterinarian does not necessarily make one a good milk inspector or meat inspector. The fundamental training of a veterinarian prepares one better for these positions than does the training for any other profession, but some additional training is necessary.

Veterinary Colleges to Blame

Our veterinary colleges are remiss in this respect. They could give the necessary additional training required for meat and milk inspection and turn out graduates well qualified in these respects; but none of them that I know anything about does it. Therefore before a veterinarian applies for a position as meat or milk inspector or before he accepts such a position, he should as a matter of duty to the community he is to serve and to his profession and to himself, inform himself on these matters.

Training Necessary

With the literature easily available on the subject and a short period of training in any city maintaining a good milk inspection department, or in any abattoir where federal meat inspection is maintained, any qualified veterinarian can qualify himself for the duties of milk inspector or meat inspector. This period of training need not be a long one nor an expensive one. With the fundamental training that a veterinarian has, he should pick up the fundamental technic of milk or meat inspection in a few weeks of such training. It is desirable that the milk inspector understand and be familiar with machinery and methods of the dairy business so as to be able to create confidence in those engaged in the industry with whom the inspector must deal. Such a period of training will at least give the individual a better conception of the problem of food control and will give a foundation upon which to build.

Swine Surgery

By E. R. FRANK, Manhattan, Kansas,
Department of Surgery and Medicine, Division of Veterinary Medicine,
Kansas State College

OPERATIONS upon swine will probably never result ordinarily in large fees to the operator but the veterinarian can afford to credit part of his fee to good will and make such operations a paying proposition to the owner and himself. The veterinarian who will castrate, reduce hernias, and perform other indicated operations giving the farmer the benefit of modern surgical methods may not reap a big fee but is well repaid in increased prestige, gratitude, future calls and his enlarging sphere of usefulness. For the practitioner who likes to do surgery the operations on swine provide an excellent opportunity to develop technique that can be used in operations on other species.

Castration

Careless castration of hogs causes heavy losses to the swine industry by injury to hams due to the formation of abscesses, scar tissue, and scirrhous cords.

In castration the operator should keep three objects in mind, to provide thorough drainage, the removal of the greatest possible amount of the tunic and cremaster muscle and control of hemorrhage.

A good skin antiseptic should be used such as tincture of iodine or any other that is efficient. For young pigs up to the weight of 40 or 50 pounds I like to use the one incision method. Start the incision in the mid-line about the middle of the scrotum and extend it an equal distance below the bottom of the scrotum. Then make two incisions through the thin membranes down to the tunics on either side. The index finger is then passed around the vaginal tunics and the contained cord of the testicle, and by traction upon it, its attachment to the scrotum is broken down so that the tunics with the contained testicle may be lifted out of the incision. The vaginal tunics are now incised longitudinally so as to permit the testicle to be exposed. The cord is grasped and the testicle forced out through the incision, an emasculator is then applied as high on the cord as possible and the cord crushed. Any efficient method may be used for dividing the cord, I prefer the emasculator.

For larger pigs where the testicles are of good size, two incisions should be used. The testicles may be used as a base upon which to make the incisions. Start the incisions as before about the middle of the scrotum but over each testicle and extend an equal distance below the bottom of the scrotum or even a little further forward into the inguinal region, carrying the incisions down to the tunics. The same procedure is then followed as described above.

By this method you have removed all the structures which would interfere with proper drainage of the wounds. If the pigs can be placed in clean quarters for a few days until the wounds have had time to heal, it will help to prevent some of the unfavorable sequellae of castration.

Scirrhous Cord

The most common complication following castration is scirrhous cord formation. The operation to relieve this condition is very painful, attempts to infiltrate the area with a local anesthetic to control the pain have not been successful so that a general anesthetic should be used or epidural anesthesia should be employed.

If it is desired to use epidural the following procedure may be used. Palpate for the anterior border of the wings of the ilia and draw an imaginary line across joining the two points, then measure back two and one-half inches on the median line. At this point insert an eighteen gauge needle three inches long in a downward and forward direction until it has passed through the inter-

space between the last lumbar vertebrae and the sacrum.

In a sixty pound pig in good condition the needle will have to be inserted about two inches to reach the epidural space. Then for each ten pounds of pig inject one cubic centimeter of a two per cent procaine solution. If the needle is properly placed no pressure will be required to make the injection. Anesthesia is usually complete in five to ten minutes and persists for approximately forty-five minutes.

In size the growth may vary from a walnut to an enormous size in comparison with the affected individual. Sometimes there is an opening in the swelling through which there is a discharge of purulent material. Blunt dissection should be used as it is less apt to cause hemorrhage than where sharp instruments are used and enough hemorrhage to prove fatal, may ensue if care is not used in the ablation of large growths. An elliptical incision is made over the most prominent part of the swelling and by blunt dissection with instruments and fingers the growth is dissected up the cord until the healthy portion is reached. The cord may be ligated and growth removed with sharp knife or it may be ablated with ecraseur or emasculator. It is very important that all pathological tissue be removed or there is apt to be a recurrence of the condition. The cavity should be packed with gauze impregnated with some antiseptic and the skin incision closed with mattress sutures of silk. Pack should be removed in 24 hours and enough sutures removed to provide adequate drainage at the lowest part of the incision.

Umbilical Hernia

Pigs are very frequently affected with umbilical hernia. In this case the rupture is through a natural opening and the hernial sac in practically all cases is lined with peritoneum. It is usually congenital and appears shortly after birth. Some palliative measures that are often recommended are of little use and in the case of irritants increase the difficulty of operation which is many times necessary later.

If the operation is to be successful it is necessary that the edges of the hernial ring be firm and definite.

The operative field is thoroughly prepared for the operation and may be anesthetized by the use of a local anesthetic. The skin overlying the area is anesthetized with a one per cent solution of any reliable local anesthetic. This is accomplished by injecting the skin along the lateral and medial sides of the area.

The deeper tissues and peritoneum may be anesthetized by a few well placed points of injection on either side of the ring.

An elliptical incision is then made through the skin including as much of the excess skin as is indicated. In the male it is necessary to make a U-shaped incision around the end of the prepuce and this portion is reflected back after which the operation is performed the same as in the female. Blunt dissection is now used to separate the skin and peritoneal sac down to the ring.

The skin should be dissected from the external sheath for a distance of an inch or more around the entire circumference of the ring. If there is any doubt about the contents of the sac being entirely reduced, it is well to make a small opening to permit inspection. If adhesions are present the sac must be opened wide enough to permit adhesions being broken down.

The peritoneal sac should now be ligated with mattress sutures of No. 4 chromic catgut at the very height of the hernial ring. The length of each mattress suture should be about ¾ of an inch and placed close together. After the sac is tightly sutured remove it a short distance above the sutures. I like to use No. 4 chromic catgut to suture the fascia together. Stitch into the fascia about one inch from the edge of the ring or further depending upon the size of the animal, have needle emerge near line of suture cross over the cut stump of the peritoneum and insert the suture into the fascia and out again using a continuous type of Lembert suture. With this type of suture you can pull the two fascias together which will bury the first line of suture and in this way is secured the strongest protection

against a recurrence. The edges of the skin are united but before the edges are brought together all surplus skin should be removed so the skin will fit up close to the abdomen and be of considerable aid in support of the sutured ring. The skin edges may be closed by a continuous suture of silk which has been immersed in tincture of iodine which helps to control stitch infection, then cover sutures with flexible collodion.

The after care is almost as important as the operation and consists in placing the animal in small, clean quarters to restrict the activity of the patient and limiting the diet to reduce the weight of the abdominal contents.

Scrotal and Inguinal Hernia

As this type of hernia is usually congenital many cases could be prevented by careful selection of breeding stock. Spontaneous recovery rarely if ever occurs in pigs so an operation is indicated.

In inguinal hernia the abdominal contents, usually intestines or omentum, have passed into the inguinal canal. Scrotal hernia is simply an exaggeration of inguinal hernia because in it the abdominal contents have passed not only into the inguinal canal but beyond that region and into the scrotum where they are lodged alongside the testicle.

The operation area in the inguinal region should be thoroughly prepared and a good skin antiseptic applied. Anesthetize along the proposed line of incision with a one per cent solution of procaine, also inject at a few points around the inguinal ring and at the point of attachment of the tunic to the scrotum. A linear incision through the skin should be directly over the inguinal ring and three to four inches long extending backward along the course of the sac. Cut through the skin, subcutaneous tissue and a sheet of white fascia to the tunic, which is so thin coils of intestine can be seen through it.

By blunt dissection isolate the tunic from the surrounding tissue and pass the index finger around it and lift from its channel at the same time working backward toward the testicle. The other hand should be used to push the testicle out of the scrotum where it can be grasped and traction exerted to pull the tunic loose from its attachment to the scrotum. The sac containing the testicle is then brought through the incision and the intestines unless adhesions are present, are forced past the ring. If adhesions are present an opening will have to be made in the sac, the adhesions broken down and then proceed as before.

Apply a ligature of silk or catgut by fixation around the cord as close to the ring as possible and remove the testicle and tunic a short distance distal to the ligature. The stump is pushed into the abdominal cavity and the ring closed with a continuous suture. This makes a complete operation with no opportunity for a recurrence.

Caesarean Section

This is an operation that is very easy to do but a successful outcome depends upon a number of important factors. Best results will undoubtedly be obtained if the operation is performed within twelve to twenty-four hours after farrowing starts. Another important point is to do as little instrumentation and manipulation by way of the vagina as possible. During the operation speed and careful handling of the uterus are essential if best results are to be obtained.

The type of anesthesia used will depend upon the operator. Local anesthesia of the structures invaded may be used, also chloroform, chloral hydrate and epidural anesthesia are easily accomplished in sows up to 250 pounds in weight.

Either side may be used for the operation and the area between the last rib and point of hip should be thoroughly prepared.

The incision should be liberal, starting about two inches below the transverse processes of the lumbar vertebrae and midway between the point of the hip and the last rib. The incision should be six to eight inches long and through the skin and muscles to the peritoneum. The peritoneum is carefully penetrated and an opening made corresponding to the skin and muscle incision. A sterile rubber sheet such as is

recommended for rumenotomies is spread over the sow with opening or slit directly over laparotomy incision.

One horn of the uterus is removed through the incision and placed on sheet. The incision through the wall of the uterus is made along its dorsal surface where blood-vessels are almost absent.

The incision should be made over the fetus which is nearest to the bifurcation. If the other fetuses can be worked out through this one incision without rough manipulation of uterus it is the desired procedure. But in some cases a separate opening will have to be made for each fetus. If possible the membranes should be removed at this time but if not they will pass out later.

The opening or openings in the uterus are closed with a double row of continuous Lembert sutures. The muscular layers may be closed with a continuous catgut suture and the skin incision with interrupted sutures of silk or tape with an opening at the lower part for drainage. Flexible collodion is then applied over the sutures and the sow placed in a clean comfortable bed.

Cryptorchidism

The word cryptorchid means hidden testicle. It may be applied therefore to a testicle lodged in the abdominal cavity or inguinal canal either unilateral or bilateral.

The operation may be performed as in

Testicle of a Cryptorchid Boar; G—Testis, H—Globus Major, I—Globus Minor, J—Epididimis, K—Spermatic Cord.

case of inguinal hernia or by way of laparotomy incision.

Either local or epidural anesthesia may be used. If the operation is performed through a laparatomy wound the testicle or testicles are usually located close to the internal inguinal ring.

After making the incision over the inguinal ring make a search for an evagination of peritoneum or for the spermatic vessels. There may be a partial evagination of peritoneum containing the epididymis, ductus deferns or gubernaculum and with the invasion of the peritoneum traction on any one of these structures will bring the testicle to the internal ring. If none of these structures are located search for the urogenital fold which will facilitate finding the testicle. The inguinal ring may be closed with continuous suture of catgut and the skin wound with a mattress suture.

Rectal Prolapse

This is quite a common condition in pigs and consists of a protrusion of the rectal wall through the anus. A large proportion of the cases presented have become congested, inflamed, lacerated and indurated so that amputation is the simplest method of handling this condition.

Anesthesia may be accomplished either by the injection of a one per cent solution of local anesthetic in a number of points around the circumference of the intestine anterior to the anus or by the epidural method.

If the lumen is large enough one finger may be inserted into the projecting bowel and the prolapsed portion drawn out as far as possible.

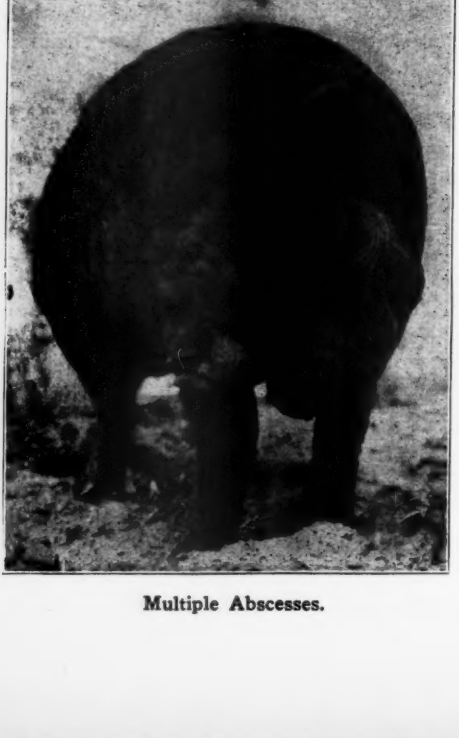
Then after the sutures are in place and the prolapsed portion removed the retraction of the intestine will carry the sutured portion well forward.

The sutures, either catgut or silk are placed in the following manner: The needle is inserted as close to the anus as possible and passed through the anus and intestine into the lumen of the bowel, then directed outward again about one-half inch from point of entrance and tied. This is repeated at a number of points around the circumference depending upon its size, usually four to eight sutures are used. The prolapsed portion is then amputated about one-half inch posterior to the line of sutures

and the sutured part retracts anterior to the anal spincter. A laxative diet should be given for a few days.

Mammary Tumors

Due to the fact that the teats and udder are in contact with the ground they readily become infected with *Actinomyces bovis*. Soon various sized swellings appear in the mammary tissue and if not treated the affected tissue may reach an enormous size. Surgical removal is indicated and anesthesia may be accomplished by injecting the skin and also depositing some of the solution in the deeper structures at the base of the growth. Two elliptical incisions are then made through the skin and the growth removed by blunt dissection. Hemorrhage must be controlled as well as possible. Special attention is paid to the artery or arteries supplying the affected mammae. Serious hemorrhage may occur if due care is not taken to control it. The skin edges are then brought into apposition by means of a continuous suture of silk or tape and flexible collodion applied over the sutures.



Multiple Abscesses.

Retention of Urine in End of Sheath

Male hogs are sometimes presented with a soft fluctuating swelling in the end of sheath and inspection shows this is due to retention of urine. An effective procedure to relieve this condition is to remove a V-shaped section from the ventral wall of the sheath at its free opening. The two divergent arms of the V are commenced at the free border of the sheath about one inch apart and carried backward in a converging manner for a distance of one-and-one-half inches. These incisions are made only through the skin down to the mucous membrane lining the sheath. The mucous membrane is divided by a linear incision commencing at the apex of the V-shaped incision and carried forward to the opening of the sheath. The split mucous membrane is then sutured on each side of the skin.

SAVING THE VACCINATION FEE

A farmer purchased serum and virus (?) and vaccinated his hogs in July, 1930. From the number vaccinated he selected 40 head of fine Poland gilts to breed for his 1931 pig crop.

Shortly after breeding these gilts he purchased more serum and virus and vaccinated one fall litter of pigs which were allowed to run with the gilts, all sleeping in the hog shed wherein the said vaccination of the pigs was done.

In about three weeks after the pigs were vaccinated, two of the gilts sickened and died. The veterinarian for the serum outfit made a diagnosis of pneumonia. Again in about two weeks after the two gilts "gave up the ghost," eleven more sickened, and veterinarians called made a diagnosis of hog cholera by autopsy. Pneumonia was a minus quantity clinically and postmortem. The animals remaining visibly well were shipped. A total of thirteen entered the great unknown a la grease tank. The potential loss was forty sows and forty prospective litters of pigs. The gain was thirteen sold, twenty-seven sacrificed at a pork price and a few dollars saved by vaccinating his own hogs.

So-called Nutritional Anemia of Pigs

By C. C. HASTINGS, Williamsville, Illinois

IN RECENT years there has appeared several times in veterinary literature a description of an old and well-known condition in pigs under the name of "nutritional anemia of suckling pigs." Within the last year some writers have dropped the words "nutritional and suckling" and have simply called it anemia of pigs. The latter name is much broader in scope and can be applied to any condition of infant swine that is subacute or chronic in character and tends to fatal termination.

Anemia is an abnormality of the blood and may be a diminution in its quantity or a decrease in some of its constituents. In all chronic diseases there are some changes in the blood and they could therefore be called secondary anemia. Some well-known medical authorities make the unqualified statement that all anemias are secondary, and the name primary anemia is a pure misnomer (Billings, Sajous). The diseases of infant pigs that have been described in veterinary literature under the names of prenatal scours, weak pigs, squealers and enzootic pneumonia could be and no doubt will be described as pig anemia, as anemia is a symptom in each of them. However, this discussion will be confined to the one condition that has recently come into the limelight.

To instigate rational treatment or rational preventive for any disease the underlying cause must first be established. As we delve down into the history of modern swine production we find there the predisposing cause of this disease. Swine have been bred for many years with the sole object in view of quick production of pork and lard. The facility of the regenerated hog to multiply rapidly, produce two litters and start another generation within twelve months has made it comparatively easy to change the type at will. The breeder has had little trouble in developing an animal that will reach market size and quality in a few months and at the same time building a carcass that contains a high percentage of edible products. The ability of modern swine to increase body weight from less than two pounds at birth to 200 pounds at six months of age is little short of miraculous. Again when we consider that such unparalleled growth is accomplished in an animal whose viscera is less than twenty-five per cent of his gross weight, the phenomenon becomes almost a paradox.

As long as each of the internal organs are functioning at capacity they are large enough to maintain health, but if for any reason the normal action of one of them is retarded, it immediately effects the growth of the animal. The hog of today compares with his wild ancestors much the same as the sunflower compares with the sturdy oak. Swine have a predisposition towards the formation of adipose tissue, consequently in their present state of over-development it is only natural to find in them a strong tendency towards fatty degeneration, and a lowered resistance to disease.

As is true in all modes of living contrary to nature, the ill-effects are visited more upon the young than on the mature animal.

All cases of so-called nutritional anemia of pigs have a similar history. It is about as follows:

The pigs are farrowed during inclement weather and are confined in small inclosures either through choice or from necessity during the first few weeks of their lives. The sows are fed a full ration, consisting largely of corn or other concentrates. The pigs satiate themselves with milk and then lie in the bed. They repeat this same performance about every two hours. When about three weeks old they become excessively fat and listless. Their weight increases abnormally fast, and at times will double within the first fourteen days. Their natural predisposition to form adipose tissue combined with lack of exercise and over-feeding causes a fatty degeneration of the entire organism, but more especially of the heart

and liver. The rapid deposits of fat in the tissues causes mechanical pressure on the blood vessel walls, thus hindering the free circulation of the blood. A blood stasis and poor peripheral circulation result. The external evidence consisting of a dry wrinkled skin, rough coat, thumps, and gangrene of the tips of the ears and tail is not uncommon. The heart in its vain endeavor to force the blood through the restricted vessels, and already weakened by fatty degeneration dilates and may enlarge until it fills most of the thoracic cavity. It presses against the lungs and simply smothers the pig hence the thumps. Due to lack of exercise and retarded function of the intestinal glands there is a marked constipation and auto-intoxication from absorption. The contents of the stagnant bowel form an ideal culture media for the growth of bacteria of the intestinal flora. The mass is liquefied and passes out in the form of a diarrhea. Enteritis is present, dyspnea is very much in evidence. The pigs are readily exhausted when forced to exercise and death may be caused by excitement or handling.

On autopsy all tissues show evidence of anemia. Fatty degeneration is one of the most striking changes. The heart is dilated and its walls thin and flabby. Fatty degeneration of the liver is constant if death occurs in the acute stage. If death does not occur until later cirrhosis of the liver will be found.

The pathological decrease in the hemoglobin level of the blood results from the fatty degeneration of the liver and is in direct proportion to the amount of parenchymatous tissue involved. Nutrition is interfered with, and when this continues to a point insufficient to maintain the normal hemoglobin level of the blood an anemic condition results. In human medicine it has been definitely established that anemia is closely associated with a retarded function of the liver, and it is an established practice to place the patient on a diet of liver, thereby supplying the deficient elements from a foreign source.

In so-called anemia of pigs there is a decrease in the number of red blood corpuscles caused, no doubt, by stagnant circulation and absorption of toxin from the intestinal tract, which interferes with the normal function of the bone marrow.

If the pig lives as long as five weeks the degenerated areas in the liver are replaced with cicatricial tissue, causing a cirrhosis of the liver. The normal function of the liver is interfered with and the pig remains a runt. In practice it has been found that such pigs have a much lowered resistance to disease and are more apt to contract current infections, especially necrosis of the upper respiratory tract and necrotic enteritis. Susceptibility to necrotic enteritis is probably due to digestive disturbances and constant irritation of the intestinal mucosa, resulting from the decreased secretion of bile. It is well known to practitioners that herds in which necrotic enteritis is found often have a history of pig scours. When holding post-mortem examinations on pigs dead of necrotic enteritis characteristic white hard livers are much in evidence.

In studying this problem it should be kept in mind that the fall in the hemoglobin content of the blood of pigs immediately following birth is a physiological condition, and should not be confused with pathological anemia. Different litters have varying degrees of susceptibility. Also milk secreted by different sows may vary both in quantity and quality. Some sows will not produce a sufficient quantity of milk to cause an over-development of their pigs. Old sows give more milk than gilts, which accounts for this disease being more prevalent in pigs produced by aged sows. Moreover, the size of the litters enter into the occurrence of this condition with the greatest of regularity. The smaller the litter the more trouble is experienced. The bacon breeds being more active are not as susceptible as the large types. Some sows are of a nervous temperament, and do not let their litters remain quiet for any length of time, thereby forcing their pigs to take a certain amount of exercise. The tendency of the swine breeder to produce a more active meat type hog has decreased the prevalence of this trouble to some extent. On the other hand,

each year finds an increasing number of pigs farrowed during the winter and early spring when the weather is bad and opportunities for exercise are limited.

In adopting preventive measures it should be kept in mind that the body weight of a pig should not increase during the first ten days of its life, and that it requires muscular activity for the proper circulation of the blood. Some provisions for exercise must be arranged so as to hold in check the natural tendency towards overdevelopment until the equilibrium of the different body functions become established and act in harmony. If the weather will permit when the pigs are six days old they should be shut out of the house and thus compelled to follow the sow. During inclement weather forced exercise can be resorted to temporarily. If a central farrowing house is used the pigs can be driven forward and back in the runway a few times each day. In case of the individual house the sows can be locked outside and the pigs driven around in the house. When only limited exercise can be arranged for it is well to supply a smaller ration to the sow, and thereby reduce the milk flow until such time as proper exercise can be provided.

Treatment is of little value. Exercise will often stop the progress of the disease, but the pigs that survive are so retarded in development that they are an economic liability to the owner. Our major efforts, therefore, should be directed along the lines of prevention. The feeding of iron and copper salts have been used experimentally for both prevention and cure, but according to some authorities the percentage of recovery remains the same in the iron and copper fed pigs as those left untreated. Since the supreme object in raising swine is to fill the pork barrel, then the feeding of metal salts is of little if any value. When we study the etiology and pathology of this disease it can be seen readily that chemotherapy could not possibly play an important role in either its prevention or treatment.

The effect of describing this disease condition under the name of "nutritional anemia" has placed into the hands of the mineral salesmen and nostrum vendor a new and effective weapon to successfully carry on their parasitic activities and further exact an ever increasing toll from one of the most important basic industries of agriculture.

The name anemia as applied to this malady is extremely misleading. Anemia is only one of the several symptoms and the name of any of the other symptoms would be quite as appropriate. Either fatty degeneration or obesity are better terms.

Let us consider the most important principle of livestock production with regard to disease prevention. It is an undisputed fact that the nearer we raise domestic animals to their natural environment the less trouble is encountered. The modern pig is the result of mating his ancestors for generations under unnatural conditions. He has been bred to a state of over-development. His housing is unnatural; his entire surroundings are unnatural. In fact everything that enters into his early life is contrary to nature, with the single exception of his feed, which is his mother's milk. Then the question is timely, when looking for trouble in the suckling pig why search in his feed?

In my opinion the basic causes of so-called nutritional anemia of suckling pigs are overdevelopment, lack of proper circulation and auto-intoxication. These can be prevented by sufficient exercise and when necessary a reduced diet. Although many swine breeders recognize the cause of this trouble and regularly adopt preventive measures, yet it is of prime importance that proper information be given to that minority of breeders who are not acquainted with the facts.

Phosphorus Deficiency in a Boar.

Post-Vaccination Troubles of Swine

By H. C. H. KERNKAMP, University Farm, St. Paul, Minnesota

THE name or term, post-vaccination trouble, merits a brief discussion of its meaning. The name, in a strict sense, is quite confining, and when literally interpreted charges the veterinarian with vast responsibilities. A strict and literal translation of it implies the occurrence or development of *any* abnormality or condition and at *anytime* after anti-hog cholera serum and hog cholera virus have been administered to a pig. The time may be two minutes or even seconds, or two years, so long as it is after the serum and virus (the vaccination) are administered. The trouble may have been a vertebral injury occasioned in connection with the release of the pig from its restraint during the serum and virus injection proceedings, or it may have been a dystocia which resulted in a fatal termination and this not occurring until several months or more after the vaccination. This illustration serves to show that both these conditions occurred after the serum and virus administration and both are therefore *post-vaccination* troubles. Many other examples might be cited. However no one would be likely to connect such occurrences (*troubles*) with the administration of the serum and virus and attribute such a happening to the vaccination.

If we confine ourselves to a strict interpretation of the name we find that it fails to take into consideration conditions which may cause disease. These may have been present or operative before or at the time the serum and virus injections are made. For example, circumstances may be such wherein some of the pigs to be treated are in the incubative stage or in a stage of unrecognizable symptoms of the malady, and whether the serum and virus were given or not, they would have sickened. In this case, it would be most likely that the pigs would show marked evidence of disease a day or two after the inoculations were made and it nevertheless would appear, especially to the less informed, to be directly associated with the serum-virus treatment. The facts are, however, that instead of being a *post-vaccination trouble* it was more correctly a *pre-vaccination* one.

The term, post-vaccination trouble, has gained general usage and usually is restricted to a narrower interpretation. The interpretation most commonly made is that it has a direct relation to the act of vaccination. In other words, all or nearly all untoward conditions or events that occur within a period of approximately forty to fifty days after anti-hog cholera serum and hog cholera virus are administered constitute what are generally placed in the category of *post-vaccination* troubles.

The attitude of some individuals to the occurrence of any undesirable conditions during this period is that such happenings are more or less as a matter of course; if no unsatisfactory situations arise, all is well and good. If they do—too bad. The explanation for this attitude is usually that those individuals are nothing more than "vaccinators." With them the immunization of swine against hog cholera means only the injection of anti-hog cholera serum and hog cholera virus. The desire to prevent or reduce troubles subsequent to the injection of the serum and virus is not uppermost in the minds of such individuals.

On the other hand, it is the desire of most persons engaged in immunizing swine to hog cholera by the use of the serum-virus treatment, to accomplish this with a maximum of success and without the intervention of any concomitant disease or condition which might lead to dissatisfaction. This can be done. In fact it has been done for two decades and it is being done at present. If hog cholera vaccination is to be attended with much post-vaccination trouble, we may expect that many owners will procrastinate in the immunization of their swine to an extent that a widespread epizootic of hog cholera may cause serious damage to the swine industry.

In this connection we would restate a fact well known to all veterinarians. *The immunization of swine against hog cholera is sound.* Let us not allow ourselves or clients to lose sight of this fact.

To strengthen the foregoing statement we might offer the challenge. With what agent or in what manner can a more satisfactory artificial immunity to any disease be produced in man or animals than by the proper vaccination of healthy susceptible swine of from 40 to 90 days of age and which are being kept under conditions of reasonable care and management? This might be construed to mean that no failures would ever occur if all these factors are brought together each time swine are to be immunized to cholera. Experience, however, proves the contrary and the reason for the failures in many of these cases is not fully understood.

The potency of serum and the virulence of virus have been stressed many times and in many places and their importance in connection with the successful immunization is well recognized. The practicing veterinarian expects when he purchases any of these biologics that they will produce the effects intended. His responsibility so far as the biological product is concerned, ceases when he has taken all due and reasonable care to obtain good products and to insure the proper handling of them after they come into his possession. There is no denying that some of the post-vaccination troubles are traceable to the serum or virus and since these are generally known a discussion of them need not be included.

The part played by the conditions surrounding the hog at the time the serum and virus are injected is another of the important aspects of the post-vaccination syndrome. Pulmonary diseases, gastro-intestinal diseases, diseases of the genito-urinary system and diseases of the blood and blood forming tissues are some of the pathological conditions that may be present in the herd at the time the treatment is to be given. If the circumstances are such that it is not imperative that hog cholera immunization be done when some other disease is present, then it is highly desirable to postpone the vaccination until the animals are again healthy and in good condition. Instances frequently arise where it seems advisable to use the serum-virus treatment notwithstanding one or more diseases are already present in the herd. For example a number of the pigs in the herd may be heavily infested with ascarids when hog cholera makes its appearance among them. Again, many of the herd may be suffering from swine "flu" or an enteritis complex when suddenly the situation is further complicated by hog cholera. Cases of this kind are not very satisfactory to encounter. They place the veterinarian in a difficult situation. For the reputation of himself and that of the serum and virus it becomes his duty to inform the client carefully of the probable post-vaccination difficulties. It was presumed that the conditions in the case just referred to were apparent to the client even before the veterinarian was summoned and the responsibilities for any untoward events subsequent to the vaccination are not those of the veterinarian. The situation is quite different if the owner is not aware of the coexistence of the two or more diseases.

Recognizing as we have that the existence in the pig of some malady other than hog cholera at the moment of vaccination has an important bearing on many *post-vaccination* troubles, we must consider the importance of detecting such maladies before making the inoculations. This calls for something in the veterinarian more than a "vaccinator." His knowledge of the attitudes, habits and characteristics of healthy swine is a most valuable asset. This knowledge as it applies to the drove in question is obtained by skilful and careful subjective examination of the swine together with careful questioning of the client. The ability of the veterinarian to recognize all signs and symptoms which point toward deviation from the normal is exemplified in this examination. Too often he but looks over the fence while some may "look but see not." If symptoms denoting abnormalities of great potential danger are observed the client should be informed and unless it is neces-

sary that the vaccination be carried out immediately, steps should be taken to correct the condition and delay the serum-virus treatment.

In some cases conditions may exist wherein no evidence of disease can be detected and the drove may appear to be one suitable for the serum-virus treatment. In this latter situation there may be pigs in the incubative stage of some malady which if it were known or detectable would justify delaying the vaccination. The veterinarian who vaccinates such a herd as this cannot justly be criticized or censured because of some post-vaccination trouble.

We have discussed post-vaccination troubles which arise when swine are given the serum-virus treatment and when some other unsatisfactory condition or disease was present. The opposite is of equal importance. Under these situations one must take into consideration the conditions which might arise where the swine come in contact with some disease after they have received the serum-virus treatment. For example, a healthy vigorous drove of pigs is vaccinated today and in the next day or so they may come in contact with some infection that will become established and cause them to sicken. The uninformed will be the first to directly associate the trouble with the vaccination. It too frequently happens in cases of this kind that the persons who should learn of this trouble do not get knowledge of it until such time as it is difficult to satisfactorily clarify the situation. This it would seem might be avoided if, when the serum-virus treatment is administered, instructions be left to notify the veterinarian of any unusual circumstances that may occur subsequent to the vaccination.

The existence or occurrence of some specific bacterial, protozoan or parasitic disease is not alone the only factor which may result in *post-vaccination* trouble. Predisposing influences of a kind such as sudden climatic changes and radical changes of diet are factors which cannot be overlooked. A case in point will illustrate. Three days after a drove of young, healthy swine were given the serum-virus treatment a cold, damp rainy spell occurred which continued for 72 hours. The climatic change first occurred in the night and the pigs were not provided with adequate shelter nor was adequate shelter provided at any time during this period. About the second day a number of the pigs sickened and in 48 hours more than 50 per cent of the drove was markedly sick and several deaths had occurred. A careful study was made of the situation with the conclusion that the exposure had reduced their defense mechanism to such an extent that the virus caused them to sicken with cholera. While it has been stated that dietary conditions play a part in post-vaccination difficulties, yet we cannot with certainty point to a definite case wherein one could ascribe the food as the principal factor leading to the trouble.

The problem of *post-vaccination troubles* of swine is one of great magnitude. Many aspects of the problem have not been discussed since they for the most part are but subdivisions of the points mentioned. This shows that the matter is a problem which requires much investigation and research under many different conditions. A brief criticism of the terminology as at present employed has been made. The criticism has not been destructive but was included to serve as a warning to those who would abide by a strict interpretation of the term and as an argument for those who must defend the best interests for the use of anti-hog cholera serum and hog cholera virus when they are attacked without just cause. The prevention of *post-vaccination troubles* is the axiom.

Erysipelas in Swine.

Problems in Poultry Disease Control

By F. D. PATTERSON, Iowa State College, Ames, Iowa

IN A discussion of this kind the first problems that come to mind are those of management, because proper management forms the foundation upon which disease prevention and control are based. The first thing that should be done in any disease outbreak is to see if any significant errors in management exist and if so to advise their correction for future as well as present benefits to your client. Some of the most significant errors that bear directly or indirectly upon the health of poultry are:

1. *Improper breeding.*—(a) Breeding from constitutionally weak birds, (b) using birds that have been forced fed for production or otherwise kept under high pressure conditions, and (c) using stock closely inbred for some special purpose without due regard for general flock stamina.

2. *Improper housing.*—(a) Poor ventilation, (b) Insufficient room, (c) Insufficient direct sunlight, (d) Improper temperature, (e) Dampness, (f) Unsanitary conditions, (g) Improper drainage.

3. *Improper feeding.*—(a) Improperly balanced diet. The most significant errors are too much or too little animal protein concentrates, improper mineral supply, insufficient direct sunlight or a potent cod liver oil substitute, (b) Overfeeding, (c) Underfeeding, (d) Feeding baby chicks too soon or too late after hatching, 48 hours is about the correct age at which to give them their first feed, (e) Damaged feeds, (f) Improper green food supply, (g) Too little grain.

4. *Improper incubation.* This is often the cause of poor hatches and unthrifty chicks.

5. *Improper sanitation.*—(a) Failure to rotate runs and to maintain satisfactory sanitary surroundings, (b) Allowing dead carcasses to lie around in the yards and houses.

6. *Improper hygiene.*—(a) Chilling, overheating and crowding baby and growing chicks is often followed by disastrous consequences, (b) Dietetic and respiratory diseases are often found in chicks kept too long in battery brooders or under similar conditions.

Control Measures Applying to All Infectious Diseases of Poultry

1. Regulate any significant errors in management.

2. Isolate or kill and burn all sick birds as soon as observed. This may not always be practical, depending upon disease and extent of flock involvement, etc., but it is an excellent general principle to follow. In some instances, depending upon conditions the removal of all well birds to new and clean quarters is advisable. The drawbacks to the latter are expense of fitting up new quarters and liability of infecting clean ground.

3. Burn all dead carcasses at once and burn or remove to places uninhabited by poultry, all droppings, litter, etc.

4. Thoroughly clean and disinfect quarters with emphasis on the former. Scalding water or hot lye water are excellent cleaning agents. Direct sunlight is our most reliable disinfectant.

5. Where practical divide the flock into small groups. This should prove very valuable.

6. Scald the feed and drinking vessels and place them where a minimum of filth and *debris* can get in them.

7. In acute infectious diseases a light diet with special emphasis on curtailing animal protein concentrates in case comparatively large amounts are used is advisable, though skimmed, or clabbered milk and especially old fashioned buttermilk, where obtainable on an economical basis, is always an excellent food for poultry and may be given in large quantities. It is especially beneficial in disease conditions. Fresh green

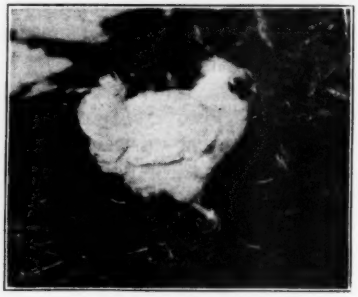
food in large quantities, especially in respiratory infections, should be of value.

8. Satisfactory housing conditions are of special interest during a disease outbreak. This factor is of especial concern in respiratory infections. The house should be warm, dry, well ventilated, roomy, free from drafts, not too hot and should be arranged so as to admit a maximum amount of direct sunlight to all parts of building as far as possible.

10. Medicinal and biological agents should be used at the discretion of the attending veterinarian to suit the particular condition in question. Their benefits are often more psychological than real, however, the former reason alone may sometimes justify their use in order to insure the institution of more valuable hygienic and sanitary measures by the owner. Antiseptics and astringents such as potassium permanganate, chlorinated lime, sulphocarbolates, catechu and tannic acid may be used in some instances but should not be considered as curative in their action but merely as accessory to more valuable measures. If used with discretion they should at least do no harm. Epsom salts at the rate of one heaping tablespoonful dissolved in drinking water for each dozen adult fowls as an initial treatment may be of some value in some instances. Often the least treated the best treated.

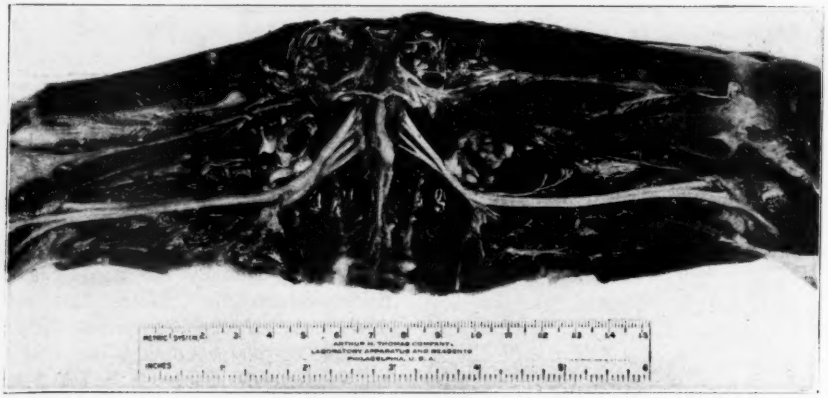
Special Disease Control Measures

1. *Tuberculosis.* Cull rigidly from a health standpoint throughout the year, eliminating all suspected birds as soon as observed. Dispose of all birds at the end of their first production year. The intradermal avian tuberculin test may be of benefit in some instances. Our experience with it indicates that all reactors are tuberculous whether lesions are revealed at autopsy or not. The test will pick out a fair percentage of infected birds but it will also leave many infected ones undetected.



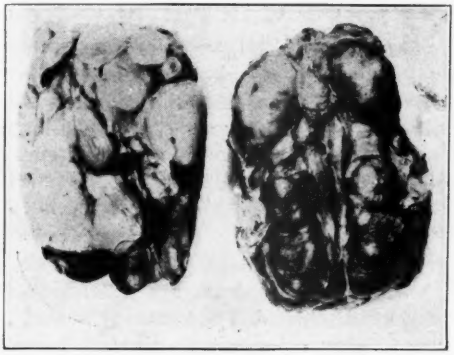
Range Paralysis
Right Leg Paralyzed; Autopsy Revealed Markedly Enlarged Ischiatic and Lumbar Nerves, Yellowish in Color

2. *So-called range paralysis.* The measures recommended here refer only to the type characterized by lymphomatous infiltrations in the nerves, eyes and other tissues.



Range Paralysis
Right Ischiatic and Lumbar Nerves and Right Lumbar Ganglion (Enlarged)

According to our present conception of its etiology and until more is definitely known concerning its inception, probably the best control measures consist in the immediate disposal of all affected birds and never



Lynaphocytomatons Infiltrations in Kidney and Liver, Apparently the Same Pathological Process Is Found in the Nerves of Birds Affected with So-Called Range Paralysis

breeding from a bird about which there is the slightest doubt as to its being affected. Some flocks become so badly involved that the elimination of the entire flock and starting anew from a flock or flocks in which the disease has never been known to occur is advisable.

3. *Pullorum disease.* Control measures consist in the elimination of all birds that show a positive or doubtful reaction to the agglutination test (in dilutions of 100 or above) and keeping baby chicks and growing chicks way from mature fowls. This precaution is of value in guarding against some other diseases as well as pullorum infection.

4. *Chicken pox.* Vaccination with a reliable attenuated virus according to the comparatively new method is very promising as a preventive measure. Field reports indicate that members of flocks to be vaccinated should be in good physical condition, otherwise undesirable results may follow. As a treatment the removal of the scabs and pseudomembranes and applying tincture of iodine to the raw surfaces may be of benefit, especially in mild uncomplicated cases.

5. *Abscesses* that follow or are associated with colds, roup, chickenpox and other causes are best treated surgically, followed by the application of tincture of iodine. Cases that are localized, where the process is complete and no systemic disturbances are pres-

Lesions in Esophagus of Experimentally Produced Vitamine A Deficiency

ent respond best to such treatment. Badly diseased birds are as a rule more profitably killed.

6. *Parasites.* (a) Intestinal parasites are best controlled by rotation of runs and strict sanitation. When drugs are desired kamala for tapeworms and nicotine sulphate for round worms are probably the anthelmintics most suitable. (b) External parasites. Body lice on well grown young stock and mature birds can be satisfactorily combated by dusting the fowls with sodium fluoride or by the less laborious method of painting the perch poles with black leaf 40. Lice that infest the heads, under the throats and wings of young chicks are effectively controlled by

applying a very small quantity of lard or other bland oily preparation to infested parts. Freshly greased chicks should not be allowed in hot sunlight and they should not be greased on damp chilly days. Artifically hatched and reared chicks should be free of lice and should remain so if kept from contact with other poultry.

Scaly leg mites can be controlled by using some oily preparation on the feet and legs of affected fowls. Kerosene is excellent for this purpose but care must be exercised to prevent the kerosene from getting on the feathered parts because if it should an obstinate blister may be the result.

Henhouse mites are best controlled by thorough cleanliness and the application of some good parasiticide to inside walls, perch poles, dropping boards, etc. A mixture of kerosene and crude oil in such proportions that the liquid can be easily applied is excellent.

7. *Nutritional diseases.* (a) Rickets. Supply sufficient minerals, especially calcium. Direct sunlight or a potent cod liver oil substitute is essential. High pressure feeding, close confinement, improper temperature, etc., are predisposing and accessory factors that should be regulated as far as practical. (b) Vitamin A deficiency. Potent cod liver oil and fresh green feed are the essential elements to use in its prevention and control.

The control of poulrty diseases depends largely upon the practising veterinarian and if he is to function properly in this capacity he must be well grounded in the fundamentals of poultry hygiene, sanitation, physiology, pathology and must be experienced in poultry matters. Like all worthwhile things such training requires time and close study but is within the reach of all who desire it and are willing to comply with the necessary requirements. With such a foundation the proper procedure toward controlling a disease problem will often suggest itself. The time has come when we must depend upon such training instead of a few minutes occasionally spent among the pages of a formula book. Until such a program is adopted the control of poultry diseases will remain a matter of speculation.

PARASITES A PROBABLE CAUSE OF COLIC IN THE HORSE

On May 10, 1931, we were called to see a Percheron mare with the colic. On arrival, it was found that she had been sick all morning. The owner had administered several doses of liniment and colic cures, also two drenches of linseed oil. We advised him that he had not left much for us to do.

The mare was standing with the forelegs spread apart, head down, nose extended and the nostrils dilated. The breathing was short and catchy; the eye had a distressed look; visible mucous membranes were cyanotic and the pulse barely perceptible.

We administered some stimulants hypodermically and made as hurried a get away as could be done gracefully, informing the owner that his mare was on her last pins. He called in about an hour and informed us that this patient had joined the invisible host. We advised him to have her taken to the rendering plant where we went and made a postmortem examination.

The characteristic lesions were found, oil in the lungs, a profuse enteritis and a ruptured cecum with resultant peritonitis.

When we opened the stomach we decided to save it for an office specimen on account of the vast numbers of bots contained in it. While examining these bots and looking for stomach lesions, we noticed a tumefaction about the size of a man's fist in the walls of the stomach. On closer examination this was seen to have several openings as if honey-combed. Upon pressure, a large number of minute *Hebronema megastoma* were expelled. The mass proved to be a veritable horde of these small round worms.

This animal had the history of having had about two sick spells such as this annually.

T. O. Scott.

Waco, Texas.

PYRETHRUM AND ITS USES IN VETERINARY MEDICINE

In a very interesting article on the internal application of pyrethrum in veterinary medicine, Ach. Urbain and G. Guillot[2] of the French Army Veterinary Service begin their discussion with a short historical review on the subject. Dufour and American authors are given credit for introducing the drug mixed with proper bases and media to combat insects. This use has increased the demand for the drug immensely and has focussed attention upon it. The petals of *Chrysanthaemum cinerariaefolium* are becoming more and more in demand. Later on the use of the drug was extended to external parasites of men and beast. In later years J. Chevalier[3] began internal medication with this drug in men and certain domestic animals. The great advantage of the drug lies in the fact that its internal application to warm-blooded animals is without any danger to them. Staundiger and Ruzicka[4] have not only described the active principles, the pyrethrines in detail, their unstable character, but also their deadly effect on cold-blooded animals. The temperature of warm-blooded animals Chevalier showed aids saponification and breaking down of resulting components of the active principles of pyrethrum which are very unstable under the influence of heat and thereby the toxic effects are greatly diminished. This fact permits internal medication of the warm-blooded animals. Roubaud and Abatucci[5] proved the insecticidal and parasiticidal character of the drug on external parasites of men and beast alike, Chevalier did the same for internal parasites. Ascarids, Oxyures, taeniae, etc. are killed (not paralyzed only) by a dilution of 1:250,000. A solution of 1:100,000 experience has shown will have a decided lethal effect upon *Ixodes ricinus*. *Argas miniatus* and *Dermannyssus gallinae* are easily destroyed by an alcoholic solution of 1:250,000. Young dogs will take very large doses without any discomfort. Doses of 10 mgm. will suffice for a completely effective treatment alike for taeniae, ascarids and the other common internal parasites of dogs. Encouraged by these experiments and their successful termination the authors began this treatment in corresponding doses in public animals, horses and mules of the Army. Remounts from certain regions of France were found to be suffering from what the authors term a "Verminous Anemia" of severe character, chronic in aspect, showing the ill-effects even after all sorts of anthelmintics had been tried to no avail whatever previous to assignment and shipment. Strongylidae and Ascarids, oxyures and other internal parasites were suspected and their eggs were found in the feces.

The superiority of the pyrethrum lies in its definite lethal not simply paralyzing effect upon the parasites themselves and that it separates them without any doubt from their attachments in the intestinal mucosae. Laxatives are rendered unnecessary, the dead parasites pass easily from the intestinal tract of the animals treated.

The dose, finally established, consists of one gram of the drug in 20 grams of castor oil. Procedure as follows: Starve animal for 12 hours; allow no water. Then give the drug and allow three or four quarts of water. Five or six hours later give another treatment (half dose only). It is recommended that the treatment be repeated 15 days later. Fecal examination, checking results are indicated four days later and again after a lapse of eight days. Several case reports are given which substantiate the above findings.—H. J. Magens.

[2] Sur les pyréthrines. Leur emploi en Médecine Vétérinaire. MM. Ach. Urbain, Commandant Vét. et G. Guillot, Capitaine Vét. *Revue de Pathologie Comparée et d'Hygiène générale.* May 1931. 31st Year.

[3] J. Chevalier, Le Pyréthre, nouvel anthelmintique vermicide. Compte Rendue, Academie de Médecine, April 24, 1928.

[4] H. Staudinger & L. Rusicka. Uber Isolierung und Konstitution des wirksamen Teiles des Dalmatinischen Insektenpulvers, *Helvetica Chimica Acta.* 1922, Teil 4, seite 17.

[5] J. Chevalier et Mercier. Sur les pyréthrines. Société de Thérapeutique 1928. Tire 34.

Formic Acid in Respiratory Disease

By C. H. GRUNERT, Fort Saskatchewan, Alberta

HUMAN Therapy has received a most valuable addition to its chapter on diseases of the respiratory system in what is known as Dr. von Kapff's "Acid Therapy." The very fact that many contributions to scientific problems have been due to mere incidental or casual discovery, although admittedly based upon keen individual observation, has also disclosed to us entirely new aspects and prospects in this particular field of internal medicine. It had been generally noticed that laborers employed in factories in which they had been continually exposed to the inhalation of acid-fumes, such as hydrochloric acid in wool and cotton factories, fluoric acid in glass factories, sulphuric acid in cellulose factories, formic acid in linoleum factories, acetic acid in vinegar factories, etc., seemed to possess an extraordinary resistance towards, if not even a certain degree of immunity to diseases of the respiratory organs and usually lived to an old age in excellent health. These observations were further substantiated during the "influenza" or "grippe" epidemic in 1918 when workmen in such concerns did not become affected at all, or only very rarely. Similar results were obtained at that time when the rooms in public schools during class hours were artificially acidulated. Quite remarkable, furthermore, seemed to be the extraordinary recovery of such people from pulmonary tuberculosis as well as their resistance to knowingly exposed TB infections. It would lead too far to quote the numerous experiments which have been conducted in hospitals, sanitoria, schools, etc., and upon which Dr. von Kapff's "Acid Therapy" was finally founded.

The important fundamental principle appears to be that during the inhalation of acid-fumes the acids will reach the bronchi and finest bronchioles and alveoles—the latter with their one-layer epithel and abundance of capillary and lymphatic vessels particularly suitable for absorption of gases. For better understanding the following illustration in the textile industry is given: A cotton rag kept in a hydrochloric acid saturated air will very shortly be changed into hydro-cellulose, whilst it will remain unchanged for several weeks if kept in a far more concentrated watery hydrochloric acid solution. At first the impression might be created that the administration of acids in their molecular state represents an excellent example of Hahneman's "Potenz" or "Involution" theory, which is at once refuted, however, if one realizes the accumulative effect which must necessarily take place in treatments continued for hours, days, weeks and even months.

Although at the present time considered a non-specific acid-therapy, the following explanations as to a possible or probable mode of action of inhaled acid-fumes are offered:

1. Organic acids dissolve mucin, fibrin and pseudo-membranes.
2. They cause hyperemia in skin and mucous membranes followed by—
3. Increased exudation. Since human and animal secretions apparently contain the bactericidal ferment "lysozym," an increased bactericidal effect of such secretions may reasonably be assumed.
4. Organic acids *per se* are known to possess antizymotic, anti-mycotic and anti-bacillary properties.
5. Extensive experiments have proved the rather paradoxical fact that acid-inhalations propagate the alkalinity of the blood and with this its H-ion concentration.
6. The katalytic and fermentative processes of the body are favorably influenced which is indicated by increased metabolism.

7. Leucocytosis and phagocytosis appear to be augmented, in fact all the bodies relating to immunization such as opsonins, agglutinins, antitoxins, paralysins, bacteriolysins, alexins, etc., enter into the maximum of their activity.

The frequent occurrence in this district of what is known as enzootic infectious pneumonia in young pigs due to *B. suisepticus* as well as staphylococcus and streptococcus infections with at times rather high mortality induced me to apply Dr. von Kapff's "Acid Therapy" in some of these cases in which the carrying into effect was practicable and feasible, and this under the following *modus operandi:*

The little pigs, if necessary with their mothers, were kept in their pens during night with doors and windows closed, allowing, however, the necessary ventilation. In different parts of the stables according to size a number of ordinary non-metallic dinner-plates, two, three or four, were placed on temporary shelves just high enough to prevent the animals of coming in accidental contact with them. Each plate was filled with four ounces of a mixture of one part of glacial acetic acid and of three parts of formic acid (85% strength) advantageously stained with 2 grs. of pyoktanin. Evaporation will take place slowly and yet sufficiently to acidulate the air in the desired manner. Since the acid-fumes are heavier than air, the pigs when sleeping will get the full benefit of them.

When preparing the premises for treatment, one will notice a stinging and tickling sensation in eyes and nose, which will also be perceived by the animals to be treated. But this is of very short duration only and will pass off in a few minutes. Otherwise not the least inconvenience or irritation will be caused by the inhalation of the wholly non-toxic fumes. During the day-time all animals under treatment were turned out into pasture and the acid-containing dishes were covered with wooden boards for reasons of economy. In addition to the usual bacterin-treatment, three lots of 84, 33 and 90 pigs respectively were exposed to the acid-treatment over a period of from 20 to 24 consecutive nights with the very encouraging results. The coughing abated and soon ceased altogether and a general improvement of the physical condition even amongst some runts could be noticed, whilst other herds under bacterin-treatment and internal administration of methylene blue without acid treatment showed very slow convalescence with coughs still continuing and general health below par, although improving.

An outbreak of infectious pneumonia of calves in 12 grade and pure-bred Holstein calves was dealt with in a similar way: Two animals died before treatment was commenced, two were very ill with all the acute symptoms of the disease, the remainder were coughing, unthrifty and with more or less abnormal temperatures. In addition to the usual medicinal and biological routine-treatment, and since formic acid could not be had immediately, the calf-pens were acidulated by keeping an employee engaged in pouring vinegar on hot bricks during the first two days, after which formic acid was used in exactly the same manner as for the pigs. The two sick animals which had been considered a sure loss by the owner made a complete recovery, whilst in the remaining eight the progress of the disease was checked, all ten calves are in the best of health today.

Although these few cases do not justify final conclusions, it is to be hoped that skepticism will not prevent at least some veterinarians from taking up this method of treatment in the above named as well as in other infectious and non-infectious diseases of the respiratory organs of all domestic animals. A very extended field for investigation is before us. May our combined efforts in the working out of, and in constructive contributions to, Dr. von Kapff's "non-specific acid therapy" in general and to formic acid treatment in particular ultimately lead to an established and scientifically acknowledged "Methodus Acidosa Specifica."

Three Pathological Conditions Affecting Ewes

By ROBERT DILL, Reno, Nevada

MUCH has been written during the last few years concerning acidosis or preparturient paresis of pregnant ewes. While some of these articles have accurately described preparturient paresis, others have described either one or both of two other diseases or conditions affecting sheep, all three being the result of poor feeding or poor management.

These three ailments are: Preparturient paresis, parturient anemia or gestation impoverishment, and a disease or condition commonly referred to by sheep men as "blind staggers." These are three separate and distinct pathological conditions, brought about by three different errors in feeding or handling, and they can be prevented or controlled by providing sufficient wholesome feed and water, or by such proper handling of the ewes as may be indicated in each herd.

These three ailments may have much history and many symptoms in common, and very often no differentiation between them is made either by sheep men or veterinarians. In fact, it appears to the writer that a description of all three of these diseases has appeared in veterinary publications under one classification, acidosis or preparturient paresis.

It may be, and very likely is true, that an acid urine will be found in an advanced case of either of these three diseases. We believe it is an accepted fact that when herbivora are deprived of food, or when, due to other causes, digestion and assimilation is suspended, the animal body subsists, as it were, on its own tissue, and thus becomes for the time being a carnivore, and will have an acid urine (The Physiology of the Domestic Animals, R. Meade Smith, Page 638). If this is true, a ewe with a badly shattered lower jaw unable to eat, if allowed to live, would soon have an acid urine, and on this basis would be diagnosed as a true case of acidosis.

Further, it is a well-known fact that sheep are prone to quit eating and starve when affected with what in other species would constitute a minor ailment. To apply the term acidosis to any disease or condition of sheep where there is an acid urine regardless of other physical or pathological conditions of the sheep, or regardless of the cause of such condition is most confusing, and does not contribute to a better understanding of the diseases of this animal.

Blind Staggers

The so-called blind staggers of sheep may affect sheep of all ages, including lambs from four months of age to old ewes or wethers. It seems to be caused by improper diet, and can be readily controlled or prevented by providing proper feed and water.

Blind staggers is seen in sheep and lambs in Nevada in late summer when the herd is on wholesome but dry range forage and the animals are not getting all the water they require. It is seen on the winter range where the sheep are feeding on rather dry woody browse and are short of water. It also may appear in a herd being fed a good quality of alfalfa hay and having a limited amount of water, or a water supply not readily accessible. These last cases are more apt to occur when the alfalfa had become too ripe before cutting and the hay is more or less woody, also, in real cool weather when the water is cold the sheep may not drink as much as they should even though the water supply be ample and accessible. Last but not least, blind staggers is also seen in late winter and

early spring where sheep are eating dead, partly rotten or moldy grass mixed with green grass regardless of the water supply. Probably the chief reason this form of disease usually occurs at this season is because there is no partly rotten or moldy grass on which to feed earlier in the winter, and to the abundance of more palatable forage.

While two or more etiological factors may enter into blind staggers, the symptoms, prognosis and gross pathological lesions are about the same. It requires a painstaking study of the case, or of the herd to detect any difference in them regardless of the cause.

Farm sheep being fed rather woody timothy or other hay may be affected the same as range sheep being fed on over-ripe alfalfa hay. From articles appearing in veterinary publications, it appears that farm sheep grazing on dead, partly rotten or moldy grass are affected about the same as western sheep grazing on similar forage.

Symptoms.—The following symptoms of blind staggers, or forage poisoning affecting sheep grazing on dead partly rotten moldy grass in Nevada have been noted. Uneasiness, the head carried high, staggering gait, grinding the teeth, impaired vision, difficulty in walking up hill, often falling in attempting to walk down hill, leaving herd and wandering away, going down and unable to arise, holding head to one side, stupor, tremors. Temperature and respiration are normal to sub-normal. In the beginning there may be impaction of rumen, later a looseness of the bowels. Some cases may recover without treatment, though many of them will die in two to four days after going down.

Lesions.—Autopsies on these cases seldom reveal gross pathological lesions other than congestion, or a mild inflamation of the meninges of the cerebellum, medulla and cervical portion of the cord.

Treatment.—The herd will respond quickly to a complete change to a wholesome diet, even though it be low in nutritive value, and plenty of fresh water.

While it has been noted in farm flocks that most of the ewes affected with this disease are carrying twin lambs, it does not necessarily signify much. Twin lambs is the rule, not the exception, among coarse wool ewes, and cross bred ewes of the mutton type, and farm flocks in general.

Acidosis or preparturient paresis and preparturient anemia are frequently observed in Nevada among semi-range sheep. These two diseases almost always occur during the fifth month of pregnancy (a few days to 15 days before lambing), when the ewes are subjected to improper feeding or handling. These two diseases are not always differentiated between by flock-masters or veterinarians because history and symptoms are somewhat similar. Unless care is taken, either condition may be mistaken for the other. Both diseases or conditions are sometimes seen in the same herd, but not often.

Preparturient Anemia

Preparturient anemia usually affects multi-pregnant ewes bred to lamb in February or March. It affects equally herds that have plenty of exercise, and those confined to close quarters. It is solely due to an insufficient diet, or simply starvation.

The food requirements of a ewe during the last thirty days of pregnancy is very much greater than that of a non-pregnant ewe. In multi-pregnancy this food requirement is still greater than in single pregnancy. In most cases this greatly increased demand for nutrients can be supplied only by feeding a first quality hay and in addition feeding a liberal grain or other concentrated feed starting forty days before lambing time and continuing this liberal feeding until the herd is lambed out. Where this generous feeding is carried out there will be no loss from preparturient anemia.

Preparturient anemia has been found in herds of pregnant ewes where they were being fed all the alfalfa hay of apparently good quality they would eat. The ewes being unable to eat enough of this hay to develop her young during the last thirty days of pregnancy and sustain her own life. Comparatively speaking, there is a greater demand for all nutrients in a ewe during the last thirty days of pregnancy than any of the other pregnant domestic animals. Also, a ewe in the fifth month of pregnancy will die of actual starvation on a ration (compared to its weight) which would not only support other species of domestic pregnant animals, but on which they would increase in weight. It is very hard, indeed, to make many sheep men realize this fact. They expect the veterinarian to find some mysterious malady of an infectious nature, and absolve their feeding methods from fault. Unless the veterinarian is careful, he may diagnose this condition as acidosis or preparturient paresis, the history and symptoms being somewhat similar.

History.—The herd is commonly confined in a corral and being fed all the alfalfa hay of apparently good quality the animals will eat. The water supply is ample and readily accessible. Lambing due to start in a few days to two weeks. The herd's general condition poor, several ewes having recently died, several more sick, some of them down. If normal parturition occurs in first stages of condition the ewe may recover.

Symptoms.— Loss of appetite, weakness, staggery gait, grinding of teeth, inability to walk up hill or climb out of ditch, goes down and unable to arise, drowsiness, coma, death in two to four or five days after going down. Temperature and respiration normal or subnormal.

Lesions.—Autopsy reveals more or less fat over back or loin, a little fat on omentum and around kidneys, but not positively emaciated. Carcass anemic but otherwise apparently normal. Ninety per cent or more of these cases are multi-pregnant. (Usually from 20 to 50 per cent of fine wool range ewes are multi-pregnant.)

Treatment.—Turning the ewes out of corral has no beneficial effect. Feeding better quality of hay and a liberal grain ration will slowly build up the general condition of the herd, and may partially stop the loss, but not entirely, as all losses from this cause seldom stop until after the herd is lambed out. As a prevention, the grain ration should be fed, starting forty days before lambing is due to start.

Pregnancy Disease

Acidosis or preparturient paresis usually affects multi-pregnant ewes when they are confined in close quarters during the last fifteen or twenty days of pregnancy. We see it in this section in January, February and March, but not in April as ewes are not kept in close quarters in April. We do not see it in December because there are no ewes in this section in their fifth month of pregnancy in December.

The general condition of the affected herd may be from very good to fair or poor. The ewes may be fed all the first quality alfalfa hay they will eat, and in addition receive a generous grain or cotton seed cake ration. The best fed herds are the ones most likely to develop the trouble.

Common history of preparturient paresis.—A herd confined in a corral, being fed all the first quality alfalfa hay the animals will eat; they may or may not be fed a grain ration. There is an abundant supply of fresh, clean, pure water; lambing due to start in a few days to two weeks; the herd's general condition very good, fair or poor; several ewes recently already dead, several more sick. If normal parturition occurs in the early stages of the disease the ewe will usually recover.

Symptoms.—Loss of appetite, drowsiness, staggery gait, grinding of teeth, progressive paresis of muscles of locomotion, paresis of optic nerve, impaired vision to blindness; the ewe unable to climb out of a ditch or walk up steep hill, goes down, unable to arise, coma and death in two to ten days or twelve days from onset of disease. Temperature and respiration normal to sub-normal.

Autopsy findings.—In some herds the carcass dead of this disease, where it has run a short or acute course, and especially where the ewe has been killed in the earlier stages of the disease for purpose of autopsy, will be very fat with large amount of omentum and kidney fat. Usually the only macroscopic lesions found being an apparent acute diffuse parenchymatous hepatitis, or just simple engorgement. The liver in nearly all cases being enlarged and greatly engorged with blood. All other organs, lymphatics and serous membranes apparently normal. Ninety-five per cent or more of the cases multi-pregnant, while total number multi-pregnant ewes in the herd will not exceed 20 to 50 per cent.

Prevention.—This disease can be absolutely checked in one or two days by turning the ewes out of the corral and forcing them to take exercise. As good a plan as any is to scatter the hay on the ground some quarter of mile or more from corral. The ewes will then travel from the corral to the feed ground and back of their own free will two or more times a day.

Mineral Deficiency

In certain sections sheep, and especially lambs, may suffer from a true mineral (calcium phosphorus) deficiency, but the history, symptoms and response to good feeding or handling is so different than in either of the three ailments mentioned above that the diagnosis of true mineral deficiency disease of sheep should offer no particular difficulty to the experienced diagnostician.

Wisconsin has imported 20,000 horses per year for the past five years to serve its horse replacement chiefly on farms. Foals in Wisconsin number only one to 40 horses.

Field investigations by Hansen on 420 farms, established that white snake root, cocklebur sprouts, water hemlock and wild cherry are economically the most important poisonous plants in Indiana, although the aggregate loss caused by sweet clover hay, black locust bark, stagger weed and buck eye sprouts and nuts is heavy.

From 1920 to 1930 the practice of drying buttermilk increased thirty-fold in Wisconsin. The state's production of dried buttermilk being 230,000 pounds in 1920 and 7,171,000 pounds 10 years later. Sales of buttermilk powder net an amount sufficient to defray ¼ to ½ of all creamery operating costs (including drying costs). Formerly the sale of fluid buttermilk seldom netted over one-twentieth of the operating cost of the creamery.

Kendall, according to *Science,* has succeeded, by varying the culture medium, in rendering invisible and filtrable the germs causing infantile paralysis, scarlet fever, typhoid fever and a number of other well known organisms including streptococci and staphylococci. These artificially produced filtrable viruses resumed their ordinary characteristics again when grown on the usual culture media. He has already succeeded in causing one invisible filtrable virus, presumably the one causing influenza, to become visible and to grow under artificial culture like ordinary bacteria. This discovery holds a promise of the artificial culture of the organisms causing measles, small pox, rabies, foot-and-mouth disease, hog cholera, etc. The ability to grow such organisms artificially might well revolutionize prophylaxis for those diseases. An insight into the nature of bacteriophage is given by this changeability of organisms from visible to invisible forms and back again. Bacteriophages seem to be merely the invisible forms of well known bacilli.

Recent Advancement in Our Knowledge of Poultry Parasitism*

By ELOISE B. CRAM, Washington, D. C.
Zoologist, Bureau of Animal Industry, U. S. Department of Agriculture

IN 1928 the writer[1] summarized the status of our knowledge of poultry parasitism at that time. During the past three years there have been notable contributions and it may be of use to workers in this field to bring together in brief form certain of these additional findings at this time.

Diseases Caused by Protozoa

Tyzzer[2], in a monographic study of coccidiosis, has furnished not only a comprehensive systematic study of species of coccidia found in poultry and game birds but also has recorded extensive scientific data as to cross-infection from one species of bird to another, diagnostic characteristics and the pathology of infections with the several species of coccidia, and control measures for them. He described four species of coccidia as occurring naturally in chickens, two species in turkeys, one species confined to the ring-necked pheasant and one species shared by the ring-necked pheasant and the bobwhite quail. As regards the species in chickens, the name *Eimeria avium* was shown to be invalid and replaced by the name *Eimeria tenella* (Railliet and Lucet) for the species which produces acute cecal coccidiosis in young chicks, characterized by the production of hemorrhage. Of the three new species described by Tyzzer, *E. mitis* is not known to be pathogenic; *E. acervulina,* producing whitish or grayish spots in the upper part of the small intestine, may cause so-called "chronic coccidiosis," leading to extreme emaciation; and *E. maxima,* producing thickening of the middle or lower part of the small intestine, accompanied by a variable amount of hemorrhage, may cause pallor, roughening of the feathers and diminished appetite. Infections with each of these species of *Eimeria* were found to die out promptly, that is, within about two weeks, in case reinfection was prevented. The severity of the disease depends on the dosage; the feeding of a single oocyst of *E. maxima* was followed by mild symptoms, with oocysts sufficiently numerous in unconcentrated droppings to make diagnosis easy.

That there is wide distribution of these four species of coccidia, described by Tyzzer from the eastern part of the United States, is indicated by their all being found in California chickens by Henry[3] and in Oregon also two additional new species, *Eimeria praecox* and *E. necatrix;* both attack the small intestine, beginning near the gizzard, *E. necatrix* in severe infections producing marked hemorrhage and dilation of the intestine. Cross immunization was shown to be lacking between *E. praecox, E. mitis, E. acervulina* and *E. maxima.*

These studies of coccidiosis of poultry, with the identification of the species involved in each case, comprise a very notable advance in our knowledge of the subject. Tyzzer's work has revolutionized the subject; previous investigations were handicapped by lack of information as to the identity of the coccidia involved, with resulting confusion due to the fact that data were incomparable because different species were involved in different studies or mixed infections rather than a single species were present without their being recognized. Crit-

* Presented in abstract at the 23rd annual meeting of Poultry Science, Lexington, Ky., August 10-12, 1931. Received for Publication July 2, 1931.

[1] Cram, Eloise B. *No. Am. Vet.,* 9, No. 11, Nov. 1928, pp. 43-51.

[2] Tyzzer, Ernest E. *Am. Jo. Hygiene,* X, No. 2, Sept. 1929, pp. 1-115.

[3] Henry, Dora Priaulx. Univ. Calif. Pub. in Zool., 36, No. 9, 1931, pp. 157-170.

chickens by Johnson[4]. The latter described

[4] (Johnson, W. T.) *In* Director's Biennial Rpt., 1928-1930, Creg. State Agric. Col., Sept. 1930, p. 119.

ical work, on a sound basis of fact, is now possible and results of great scientific and practical interest are to be expected in the future.

Renal coccidiosis in geese has been reported for the first time in this country (McNutt[5]), causing severe losses among goslings in two successive years in northern Iowa, and a description of the clinical symptoms and pathology of the disease as seen here has been furnished. There were no recoveries among the affected geese. Looseness of the bowels and whitish feces are early symptoms; the eyes become sunken and dull and the bird displays general weakness with drooping wings and beak moving in an unsuccessful attempt to make a sound. Extreme emaciation ensues, with death occurring after one to three days of symptoms. The entire kidneys are affected; enormous numbers of coccidia in various states of development are to be found in the kidney tissue. Oocysts were also found in these cases in the intestine. Young ducks raised with the geese were not affected.

As regards protozoan infections other than coccidiosis, Volkmar has described from turkeys of Minnesota and North Dakota cases of the blood parasite, *Leucocytozoon smithi*[6], and of a new species of trichofrom the upper digestive tract. The trichomonads were found always to be associated with peculiar lesions of the mucous membrane, the lesions starting as small tumorlike granulations which increase in size, coalesce and become necrotic; in the proventriculus they may occlude the lumen and prevent the passage of food. The relation of the flagellates to the disease is still uncertain. One hundred and five turkeys, naturally infected with trichomonads and showing the characteristic lesions, have furnished the basis for Volkmar's observations, with 1,700 turkeys, free of lesions and of trichomonad infection, serving as controls.

[5] McNutt, S. H. *Jo. A. V. M. A.* LXXV, *N. S.* 28, No. 3, Sept. 1929, pp. 365-369.

[6] Volkmar, Fritz. *Jo. Parasit.* XVI, Sept., 1929, pp. 24-28.

monad, *Trichomonas diversa*[7], the latter

[7] Volkmar, Fritz. *Jo. Parasit.* XVII, Dec., 1930, pp. 85-89.

As regards gallinaceous game birds, O'Roke[8] has made an extensive investigation of a new species of blood parasite, *Haemoproteus lophortyx,* found in the California valley quail. The life history involves transmission of the parasite by a louse fly, *Lynchia hirsuta.* All stages in the life cycle have been observed and described. The effects of the parasites vary from infections which appear to be benign to those which are fatal.

A severe epizootic of trichomoniasis among young bobwhite quail being raised in captivity in Virginia has been reported by Allen[9]. The protozoan infection was lo-

note 28.) Also in *Jo. Parasit.* XVI, March 1930, p. 162.

cated in the ceca; the walls of the ceca were so thin as to be transparent; the contents, liquid and greenish-yellow in color, were voided frequently. It was concluded that flies probably spread the infection among the quail, as the trichomonads were found in the intestines of the flies. Chickens were experimentally infected with the trichomonads and the same pathological conditions found in them as in quail. Allen also records the finding of the parasites of malaria, identified as *Plasmodium praecox,* in blood smears of 17 out of 45 quail in Georgia.

Worm Parasites of Poultry

Flukes.—Additional cases of infestation of chickens and turkeys of Minnesota with the fluke *Collyriclum faba* have been reported by Riley[10]. This parasite occurs in cysts in the skin. It has been found in six additional areas; English sparrows also being affected, sometimes with large numbers of the flukes, these birds are undoubtedly the means for the spread of the parasite among poultry. All affected fowls were found to have had access to swampy lake shores and there is evidence that dragon flies serve as the second intermediate host. Experimental work is now in progress in order to determine this point.

The fluke, *Cotylurus flabelliformis,* has

[8] O'Roke, Earl C. Univ. Calif. Pub. in Zool., 36, No. 1, 1930, pp. 1-50.

[9] Allen, Ena A. (*In* Stoddard, Herbert L.) (See foot-

[10] Riley, William A. *Poultry Sci.* X, No. 4, May 1, 1931, pp. 204-207.

been described by Van Haitsma[11] from the intestines of ducks, including the domestic duck, of Michigan. Investigations of the life history of this species have demonstrated that a variety of snails may serve as hosts for the intermediate stages and a variety of birds as hosts for the adult parasites. Seven species of ducks have been infected; the parasite was also developed experimentally in a young chicken. Marked clinical symptoms were noted, but because of the absence of controls the observations are inconclusive; the pathological changes brought about by the parasites in the intestinal mucosa, however, are very distinct, the epithelium being digested away and the subepithelial blood vessels congested.

Flukes in the liver of a domestic turkey originating from North Dakota have recently been identified by Price[12] as a species of *Amphimerus*. This constitutes the first record of a species of this genus from a domestic bird; the liver was badly damaged by the parasites.

In Europe Szidat[13] has contributed notably to our knowledge of the life histories of various flukes which occur there in domestic birds, such as the schistosome, *Bilharziella polonica,* found in the blood vessels of the pancreas of ducks, and of monostomes, species of *Notocotylus* and of *Catatropis,* found in the ceca of gallinaceous birds as well as of water birds.

Roundworms.—Ackert and his coworkers have made thorough investigations of the relation of vitamins in the diet to the resistance of chickens to parasitism with *Ascaridia lineata.* Chickens were experimentally infected with *A. lineata* and the number and length of the worms which developed in the birds were taken as criteria of the resistance of the bird to parasitism. The resistance was found to be considerably lowered by deficiency of vitamin A[14], the number of worms developing and the size of the worms both being significantly larger than was the case when the diet was adequately supplied with this vitamin. With a deficiency of vitamin B the number of worms which developed was greater, indicating lowered resistance on the part of the bird, but the size of the worms was less, than on a diet with sufficient vitamin B[15], the latter result indicating that vitamin B, or some other factor in the yeast which was used as the source of this vitamin, is favorable to the growth of the worms. Weakened peristalsis resulting from vitamin deficiency is regarded as the probable factor which is favorable to the development of a larger number of parasites, in both sets of experiments.

On the other hand, lack of vitamin D[16] was not found to affect the resistance of chickens to *A. lineata,* neither the number or the size of the worms being affected by a deficiency in this respect. However, the *effects* of the parasitic infestation were more severe; the chickens on the diet deficient in vitamin D did not make a gain in weight comparable to that of the chickens on an adequate diet. Vitamin D is therefore considered a factor in protecting chickens against the effects of parasitism.

That injection of an extract of *A. lineata* into chickens has little effect on their immunity or resistance to parasitism with this roundworm is indicated by experiments conducted by Rebrassier and McCrory[17]. The only beneficial effect noted was a reduction of the enteritis produced by the parasites; the number of worms which developed in the chickens which received the extract was greater than those which received no extract.

In Europe the relation of wild birds to the spread of gapeworm disease among poultry has been given considerable attention. In England starlings, and on the continent jays, rooks, and crows have been considered to play important parts in the

[11] Van Haitsma, John P. Papers of Mich. Acad. of Sci., Arts and Letters (1930) XIII, 1931, pp. 447-482.

[12] Price, E. W. Reported before The Helminthological Society of Washington. Proceedings now in press.

[13] Szidat, Lothar. *Arch. f. Geflügelk.,* Berl., 3 (3), Marz 1929, pp. 78-87. Ibidem, 4 (4), März 1930, pp. 105-114.

[14] Ackert, James E., McIlvaine, Marian Fisher, and Crawford, Naomi Zimmerman. *Am. Jo. of Hygiene* XIII, No. 1, Jan. 1931, pp. 320-336.

[15] Ackert, James E., and Nolf, L. O. Ibid., pp. 337-344.

[16] Ackert, James E., and Spindler, Lloyd A. Ibid., IX, No. 2, March 1929, pp. 292-307.

[17] Rebrassier and McCrory, Ohio Agr. Exp. Sta. 49th Rpt. (1929-1930), Jan. 1931, pp. 190-191.

dissemination of gapeworms, because of the fact that these birds very commonly harbor gapeworms which are morphologically identical with *Syngamus trachea* of domestic fowls. However, Taylor[18] has experimented extensively with cross-transmission of gapeworms from starlings to chickens, comparing the results so obtained with parallel feedings of gapeworms of chicken origin transmitted to chickens, and has obtained evidence that there are definite physiological differences between the chicken and the starling gapeworms. The physiological adaptation appears to have resulted in different strains of *Syngamus trachea* in different bird hosts. In addition to the fact that starling gapeworms were much less virulent for the chicken than was the strain of chicken gapeworms, three differences in behavior were noted for worms from the two sources, as follows:

a. The rate of growth of *Syngamus* from chickens was more rapid than that of *Syngamus* from starlings, in the chicken host.

b. The number of larvae of *Syngamus* which develop to maturity is much less in the case of those of starling origin than those of chicken origin.

c. *Syngamus* of starlings attaches itself to the upper half of the trachea, that of chickens to the lower half.

Taylor has therefore come to the conclusion that wild birds do not play the important part that has been ascribed to them in disseminating gapeworm disease among chickens.

Investigations conducted by the writer[19] on life histories of roundworms of the general group of spirurids have thrown considerable light on this important phase of poultry parasitism. Spirurids are heteroxenous, that is, an intermediate host is necessary for the development of the larval stages of the parasite. Such intermediate hosts have been reported for six spirurids which occur as adults in poultry and gallinaceous game birds. In the case of *Gongylonema ingluvicola,* two species of dung beetles were reported as naturally infected with the larvae. In the case of the other five species, all stages of development, both in intermediate and in final hosts, were experimentally produced. For *Cheilospirura hamulosa* and *C. spinosa,* adults of which were developed in the gizzards of chickens and of ruffed grouse and quail, respectively, two species of grasshoppers were found to serve as intermediate hosts. For the remaining three spirurids, each of which occurs in the proventriculus of its bird host, the findings were as follows: For *Tetrameres americana,* developed as adults in the chicken, pigeon, quail, grouse, duck (1 case) and turkey[20], grasshoppers and cockroaches[21] served as intermediate hosts. For *Seurocyrnea colini,* developed as adults in quail and, as immature forms, in a chicken, cockroaches served as intermediate hosts. For *Dispharynx spiralis,* developed as adults in the grouse, quail, and pigeon, two species of isopods (sowbugs) served as intermediate hosts. Failure to infect chickens with *D. spiralis* originating from grouse has raised the question of the possibility of physiological strains of this species existing in different bird hosts. Studies of the morphology and the behavior of the larvae in the intermediate hosts showed each species of spirurid to have characteristics distinct from the others.

Tapeworms.—Whereas three years ago our knowledge of the life histories of poultry tapeworms was extremely limited, experiments conducted by Myrna F. Jones have resulted in a succession of discoveries as to the identity of intermediate hosts for several of the species of tapeworms which are of common occurrence in this country. In the case of *Hymenolepis carioca*[22; 23], for which earlier evidence of an incomplete na-

[18] Taylor, E. L. *Annals of Trop. Med. and Parasit.* XXII, No. 3, Nov. 9, 1928, pp. 307-318. Ibid. Proc. 4th World's Poultry Congress, London, July 22-30, 1930, pp. 433-438.

[19] Cram, Eloise B. Proc. 4th World's Poultry Congress, London, July 22-30, 1930, pp. 529-534. Ibid. Tech. Bul. 227, U. S. Dept. of Agric., Feb. 1931, pp. 1-27.

[20] Later finding. Note presented before The Helminthological Society of Washington, proceedings of which are now in press.

[21] Ibid.

[22] Jones, Myrna F. *Jo. Agric. Res.,* 38, No. 11, June 1, 1929, pp. 629-632.

[23] Jones Myrna F. *Jo. Parasit.* XVI, March 1930, pp. 158-159 and 164-165.

ture incriminated the stable fly, it has now been demonstrated that dung beetles represent the intermediate hosts and for *Raillietina cesticillus*[23], for which formerly there was only incomplete evidence that the house fly might serve as intermediate host, there is now conclusive experimental evidence that both ground beetles and dung beetles serve in this capacity. These two tapeworms are the species most commonly found in the vicinity of Washington, D. C. The cysticercoids have been obtained from a considerable number of different species of beetles, in some cases natural infections and in other cases experimental infections being involved; there are therefore indications that the list of intermediate hosts for these tapeworms is extensive. The practical results of these discoveries are considerable. Beetles breed in places where flies would not breed, in drier places, for instance, and they also appear much earlier in the season than do flies. If screening is resorted to as a means of protecting poultry from tapeworm infection, there must be used a mesh sufficiently small to exclude the beetles as well as flies.

As regards *Davainea proglottina,* Sawyer and Hamilton[24] have added another species of slug to those previously known as intermediate hosts, and various snails have been demonstrated by Jones[23; 25] as capable of serving in this capacity. Cysticercoids of *Metroliasthes lucida,* a tapeworm of common occurrence in turkeys, have been developed in grasshoppers[26]. In the case of *Choanotaenia infundibulum,* for which the house fly and a dung beetle were previously known as intermediate hosts, Jones has incomplete evidence that a ground beetle may be an additional possibility.

Jones[23] has also described a new species of tapeworm, *Raillietina (Paroniella) magninumida,* and its life history. The guinea fowl is the final host and two species of ground beetles[27] have been found to be intermediate hosts of this tapeworm.

Significance of Poultry Parasites to Game Birds

The report of Stoddard[28] on the results of a five-year study of the bobwhite quail, both wild and captive birds being considered, contains much of direct or of indirect significance in connection with poultry parasitism. The use of bantams for rearing quail chicks led to serious infestations with tapeworms, the birds dying or being stunted in growth as a result of the parasitism. Cram, Jones and Allen cooperated with Stoddard in an investigation of the internal parasites. The protozoan infections most commonly met were coccidiosis and blackhead; sixteen species of roundworms and five species of tapeworms were found. The majority of the worm parasites are forms which occur in chickens. Cross-transmission was experimentally demonstrated in a considerable number of cases.

BACTERIOPHAGE INEFFECTIVE IN PULLORUM DISEASE

Several bacteriophages for *Salmonella pullorum* were prepared by Mallman of the Michigan Station. These bacteriophages, when injected into *Salmonella pullorum* infected hens, did not cause recovery. *Salmonella pullorum* was isolated in all cases at autopsy. In naturally or artificially infected chicks, the bacteriophage had no therapeutic value. Chicks were treated with bacteriophage and later exposed to *Salmonella pullorum* infection. No beneficial results were obtained. Bacteriophage and susceptible *Salmonella pullorum* cultures were isolated from the same tissues of the chicks examined. Small doses of bacteriophage had no beneficial effect while large doses caused an increased susceptibility. Bacteriophage had no prophylactic or therapeutic effect in pullorum disease of chicks or adult stock.

[24] Sawyer, C. E. and Hamilton, C. M. Ann. Rep. West. Wash. Exp. Sta. (1928-1929), Oct. 1929, pp. 14, 44-45.

[25] Jones, Myrna F. *Jo. Parasit.* XV, No. 3, March 1929, pp. 223-224, and No. 4, June 1929, p. 298.

[26] Jones, Myrna F. *Jo. Parasit.* XVII, No. 1, Sept. 1930, p. 53.

[27] Jones, Myrna F. *Jo. Parasit.* XVII, No. 4, June 1931, p. 234.

[28] Stoddard, Herbert L. The bobwhite quail, its habits, preservation and increase. New York, 1931, 559 pp.

Reviews and Abstracts

By FRITZ VOLKMAR, Columbus, Ohio

Vitamines in Animal Nutrition

In a recent investigation[1] of the relation of vitamines to the rearing of animals it was pointed out that due to the individual variations of the test animals, at least three or four animals should be taken for each feeding trial for the determination of the vitamine content of foods in order to exclude deceptive reasoning from the frequently varying results of the experiments. Guinea pigs, being herbivorous, have a greater need for vitamine C, a fact which has been little taken into account in their use for determining the absence of this vitamine factor. For the determination of the sufficiency of vitamine C presence in cows milk for infant feeding, the use of guinea pigs is unsuitable, because their need of vitamine C exceeds that of infants. The guinea pig tests with summer milk (green feeding) and winter milk (dry feeding) were contradictory in so far as alternately the one or the other would seem to be superior in vitamines.

Experimental scurvy in guinea pigs is easily cured and prevented by the use of green feeds, plant juices and barley sprouts. In the artificial nutrition of infants with cows milk, the content of the unstable vitamine C may be prophylactically corrected by additional feeding of fruit juices at the beginning of the third month.

Young growing rats and pigs (omnivores), and even more so young dogs and cats (carnivores), are less sensible to the lack of vitamines than guinea pigs. However, they'll come down with rickets when fed on vitamine D—poor diet. The development of rickets is favored by all kinds of infection, but it occurs also without it from a one-sided vitamine poor diet and from lack of light, air and exercise.

As a protective and curative remedy for rickets in children, Huldschinsky's light treatment with ultraviolet rays from the mercury quartz lamp has been considered exceedingly effective.

The ultraviolet ray treatment of animals (including milk cows), for the purpose of increasing the vitamine content of milk is absolutely inoperative, on account of the dense haircoat and the pigmented skin. Likewise direct application of the rays to the udder of the cow has been recognized as useless. Besides, prolonged application causes inflammatory reddening of the tender skin of the udder. On the other hand, direct ultraviolet ray treatment of cow's milk and powdered milk by means of the mercury quartz lamp, increases their vitamine content considerably. Feeding such milk or milk products to infants or experimental rats, cures and prevents rickets. The use of irradiated milk has this advantage over irradiated ergosterin (vigantol), that even by using excessive amounts of irradiated milk, an overdose, and therefore injurious effects on the health, cannot result. Overdosing or prolonged use of vigantol in children and experimental rats has caused damages to the kidneys, vascular sclerosis and cachexia.

Irradiated milk is an excellent prophylactic against rickets in children for the reason that the milk contains a large amount of easily assimilable calcium; according to Teichert 1.5 to 2.9 gm. calcium oxide per liter. The admixture of vigantol (viosterol) to feeds does not produce an increase of milk fat in the milk of cows. It follows that the vitamines in the different plants are produced by living green plants only, under the influence of the ultraviolet rays of sunlight. Since the young green feeds, the various vegetables, the plant and fruit juices, sprouts and good silages are rich in vitamines C and D, it is possible to get vitamine rich milk from pastured cows or stabled cows fed succulent feeds. Thus it was entirely wrong on the part of physicians to insist on dry feeding of cows for the pro-

[1] Bongert, J. The Importance of Vitamines for the Rearing of Domestic Animals. *Tierärztl. Rundschau* 37 (1931): 1-4; 17-21 & 33-38.

duction of infant milk under the assumption that thus alone could be obtained a uniform and healthy milk. Natural feed, extensive pasturage and addition of sufficient green feed or silage, when the cows are stabled, plus several hours exercise outdoors are the fundamentals for the production of wholesome milk.

The intestinal disturbances consisting of diarrhea, pica-like symptoms and stunted growth that are seen in young calves after the feeding of boiled milk or milk heated to 85° C for one minute, are considered to be deficiency diseases comparable to scurvy of infants and guinea pigs, brought about by the oxidation and destruction of vitamine C through the heating of milk. Feeding experiments on young calves have demonstrated that these deficiency diseases can be prevented effectively by supplementing the heated milk with the feeding of chopped green feeds. The rearing of calves free from tuberculosis, the basis of the effective combating of bovine tuberculosis, may be realized in this manner with little economical distress.

Epidural Pernocton Anesthesia in Dogs

Pernocton is a 10% solution of the sodium salt of the secondary butyl-B-bromallyl barbituric acid of the chemical formula $C_{12}H_{14}O_3N_2BrNa$. It was first employed intravenously and subcutaneously in human medicine. Later it was also introduced into veterinary therapeutics by Hinz (1927), Freese (1928), Lentz (1928), Berge (1929) and Westhues (1929), the use being by intravenous injection. At the request of the Director of The Clinic, Prof. Dr. K. Pardubsky, the author[2] examined the action of Pernocton when injected epidurally according to the method employed and described by Pape and Pitzschk (1925) in the horse and by Zemaitis (1928) in the dog. Pernocton was injected epidurally, that is directly into the spinal canal between the first and second coccygeal vertebrae. The investigations were made upon 30 experimental dogs and in one dog for a cyst operation, one for Voronoff's rejuvenation operation and two dogs for demonstration operations.

Whenever possible, healthy experimental animals without organic defects were procured, without regard to age or state of nutrition of the animals. In one 10-year-old experimental dog, a pronounced arythmia of the heart was found before the injection. The experiments were so conducted that the Pernocton, in a 10% solution was injected epidurally in ascending doses. The initial dose was 1cc. Pronounced reaction was seen from it in all dogs. From injections of 3 to 5cc (according to size of dog), motor paralysis of the posterior extremities occurred. The dogs swayed in the hind parts, and in some cases fell down. Sensibility was considerably decreased over the entire body, especially in the region of the hind legs. Complete narcosis, accompanied by profound anesthesia was obtained with 1cc of a 10% solution of Pernocton in a dog weighing 3kgm (that is 0.3cc, 10% sol., or 0.03 gm substance per kilogram liveweight). In some instances narcosis set in during the injection. In other cases, complete narcosis did not occur until after 5 to 7 minutes. In the latter cases, a short stage of excitation was observed. The dogs were unruly and whined before they fell asleep. During the narcosis the dogs remained perfectly quiet, they exhibited relaxed muscle tonus; the respiration was slowed down, regular, easy and deep. The reflexes were in complete abeyance. In well-fed dogs the narcosis lasted from 2 to 3 hours. In worn out dogs, narcosis lasted longer, even as long as seven hours.

In two dogs, permanent paralysis of the hindquarters resulted from injections, repeated 4 to 5 times. No improvement of the paralysis could be noticed even after prolonged observation. The paralysis may possibly have been due to a slight caustic action of the barbituric acid. Permanent injury to motility or sensibility as a sequel to a single epidural injection of Pernocton has never been observed.

In a few dogs, the snoring reported by Berge and Freese was noticed. Vomitus,

[2] Mikulec, J. Epidural Pernocton-Narcosis in Dogs. (Thesis from the surgical clinic, Veterinary College, Brunn, Czechoslovakia); abstr. *Prag. Arch. f. Tiermedizin*, pt. B vol. 10 (1930):346.

inspiratory dyspnea and râles, mentioned by the same authors did not occur in any of the case. In some instances the pulse was somewhat accelerated. The fall of the body temperature as mentioned by Berge and Freese was striking in all cases. The deeper the narcosis, that is, the larger the amount of Pernocton injected, the lower fell the body temperature, in some cases as low as 34° C. (93.2° F). With the cessation of narcosis, the body temperature rose steadily. During one of the stages of excitation a moderate rise in body temperature was noticed.

No record of a noxious action upon the heart activity could be established. Whether the epidural injection of Pernocton was made slowly or fast, no influence upon the depth and duration of narcosis resulted. A 12 to 16 hours duration of the narcosis, recorded by Berge from the intravenous injection, was not observed.

The observations recorded here lead the author to the conclusion that Pernocton has excellent possibilities as a surgical anesthetic for dogs, because it produces complete narcosis of several hours duration with relatively small doses. The epidural application of Pernocton is easily achieved in the dog and has no harmful consequences. In the opinion of the author, this form of narcosis means a decided progress in canine anesthesia.

Virulence of B. Tularense[3]

An account of natural tularemia epidemics in Norway is given. The observation is made that hunters show a more severe type of the disease than the game dealers. It is believed that the infection from fresh blood is the more virulent, while in rabbits, kept in cool rooms, the virulency of the germ may have decreased.

Immunization Against Tetanus[4]

The experience of others that addition of 2% Formol to tetanus toxin and storage at 37° C. for three to four weeks will detoxicate it is confirmed. Guinea pigs and one horse were immunized successfully with such formoltoxoides against many times the lethal dose of tetanus toxin.

Pigeon "Milk"

Pigeon "milk" is a white, slimy substance in the crop of the parent birds at the time of rearing the young. Its formation may be divided into two separate and distinct phases.

The prosecretive phase constitutes the process by which the globules of fat are stored in the cells of the crop. The observations of the authors[5] suggest that the deposition of fat in these cells is by a secretory process. The fat droplets begin to appear in the part of the cytoplasm next to the nucleus and take on the form of small globules. The formation of the fat droplets in the nutritive epithelium sets in a few days following the beginning hypertrophy of the crop. After considerable fat has formed in the nutritive cells, they rarely divide. It is assumed that the deposition of fat in these cells is associated with cell degeneration.

The second phase is the desquamation phase, that is, the process by which the superficial fat-laden cells are separated from the crop epithelium and come to lie in the lumen, constituting the pigeon "milk." From here it is regurgitated to the beak of the young squab. This final process of pigeon "milk" formation cannot be considered a secretory one. It simply involves a desquamation of the epithelial cells that are laden with fat, into the lumen of the crop. Here we have the whole cell protoplasm plus its storage granules (fat) forming the final product of pigeon "milk."

The formation of pigeon "milk" seems to differ from the sebaceous "secretion" in that the entire cell does not become vacuolated and disintegrated until it has become desquamated into the lumen. The chief difference in the mechanics of the formation of the final products of the oil glands of birds and that of the pigeon crop seems to lie

[3] Bang, B. Tularemia. *Tierärztl. Rundschau* 37 (1931): 57-60 & 73-75.

[4] Bierbaum, K., and Rasch, K. Immunization against Tetanus with Formoltoxoides, *Tierärztl. Rundschau* 37 (1931): 249-251.

[5] Beams, H. W., and Meyer, R. K. The Formation of Pigeon Milk. *Physiol. Zoology* 4 (1931): 486-500.

in the fact that the outermost cells in the oil glands of birds appear to break down completely by vacuolization and, subsequently, to empty their contents into ducts, while in the pigeon crop the cells are sloughed off *in toto* into the lumen and subsequently disintegrate.

It is noted that the secretion (synthesization) of the globules of fat in the cells of the lobes of the pigeon crop is perhaps very similar to the formation of the globule of fat in the epithelial cells of the mammary gland. At any rate the formation of the so-called pigeon "milk" is a unique process among vertebrate animals, in that a complete sacrifice of cell structure takes place to form the nourishment for the young.

Cause and Prevention of Osteomalacia[6]

Osteomalacia is a dysfunction of the calcium metabolism, accompanied by acidosis. Regulation of the calcium metabolism is brought about by magnesium which forms a buffer for the entire mineral balance; it carries the calcium in the body in the proportion 1:10. Depending on the kind of anion combined with magnesium, the combination may either bind the calcium or expel it. Combinations which inhibit the resorption of calcium and cause its loss through urine and feces, are sulphates, carbonates and acetates of magnesium. Combinations which promote the resorption of calcium and retain it for about 24 hours are chlorides, lactates and phosphates of magnesium. Combinations which promote the resorption of calcium and retain it for a long time in the body are glycuronate of magnesium and colloidal magnesium hydroxide. The latter fixates the calcium in proportion 1:70 for 10 to 15 days. The animals get their correct magnesium of the chloride type in green and yellow to red coloring principles, chlorophyll of grass, hay, straw, vegetables and fruits. Chlorophyll is denatured through the influence of heat, drouth and acetic fermentation (in silages) and thus changes to a magnesium combination of the sulphate type which disturbs the calcium metabolism. This is the reason why osteomalacia occurs after feeding of leached hay. The prophylaxis and therapy of osteomalacia consists in substituting feeds of denatured chlorophyll with roughage of correct magnesium content. Care is to be taken that other factors of calcium metabolism are present: optimal reaction, accessory thyroids, vitamines, light, especially ultraviolet rays of the wave length 2300 Angstrom units. The denatured chlorophyll of the "burnt" hay may be changed into correct magnesium combination by proper chemical action. This action is brought about by the additional feeding of colloidal magnesium hydroxide. It may also be given parenterally.

[6] Becka, J. Origin, Prophylaxis and Therapy of Osteomalacia from the Biochemical Point of View. *Schweiz. Arch. f. Tierheilk.* 73 (1931): 173-181.

Diet and Osteomalacia[7]

The laxative action produced by feeding fermenting feeds causes loss of bases in connection with organic non-reabsorbed acids. If these bases are not restored by means of feeds rich in bases, such as large amounts of leguminous hay, and supplemented by bases from appropriate mixtures of mineral salts, a gradual deficiency in bases will develop, leading finally to osteomalacia. This will occur so much easier, the less the amount of hay fed and the smaller the proportion of legumes. Concentrates, when not corrected with minerals, will have the same effect. Overfeeding with acid feeds and the feeding of insufficient quantities of hay not only causes deficiency of bases in the organism, but also deficiency of fat soluble vitamines. Furthermore, dysfunction of bowel activity almost always will render the resorption of vitamines more difficult.

Coccidiosis in Cattle

The author[8] made the observation that coccidiosis (*Eimeria zürni*) befalls cattle of all ages, that frequently clinically healthy cattle are carriers and that, as a rule, the course of coccidiosis is rather mild, without severe intestinal lesions and without bloody

[7] Müller-Lenhartz. Etiology of Osteomalacia. *Berl. Tierärztl. Wchnschr.* 47 (1931): 97-100.

[8] Pirani, A. Report of the Serum Institute Erythrea. *La clin. vet.* 52 (1929): 311-327.

feces. In years of severe drouth, however, especially during the months of November and December, the disease increases in severity and mortality. The increase in virulency is explained in part by the scarcity of feed. Coccidiosis would therefore have to be considered as a starvation disease.

Pirani's train of reasoning lends added weight to the suggestion "that some accessory or predisposing factors are involved in addition to ingestion of ripened oocysts." It would explain why "the appearance of the disease seems to be synchronous with the advent of more severe winter weather" and "why infestation fails to appear more frequently during summer and fall, when the cattle are on pasture and the range with access to low moist coulees and pot-holes." It is not contradictory to Central European experiences of occurrences during wet summer months when the stall feeding with damaged forage is considered. The former difficulties and unsuccessful attempts of investigators to reproduce bovine coccidiosis artificially must therefore be obvious. (Compare also results of Ackert and coworkers in their studies of The Resistance of Chickens to Parasitism Affected by vitamin A and B, abstr. *Jour. Am. Vet. Med. Assoc.* 78: 718-719.)

A Vaccine for Papillomatosis in Cattle[9]

The treatment consists of a vaccine prepared from cattle warts (not autogenous) at the dermatological University-Clinic, Breslau, Germany. This vaccine is sterilized at 56° C. (133° F.) for two hours and Berkfeld filtered. The dose is 5cc to 10cc subcutaneously, applied 3 or 4 times, at weekly intervals. The author considers the therapy an immune therapy. The following is a protocol of cases:

1. Of six affected animals in a herd two had an especially aggravated form of papillomatosis; one was left untreated as check. It died after immense spreading of the warts; the other five were cured with four applications each of 10cc of the vaccine.

2. Three animals; one untreated as check; observation extended over a period of five months showed that the warts were spreading; in the two treated animals the skin cleared in short time; treatment of the check animal after five months resulted in recovery also.

3. One animal severely affected; sale to the butcher was frustrated due to uselessness of meat and hide; two vaccine injections were given at 10-day intervals; the warts disappeared; four weeks later the animal was sold at full value.

4. A cow with hundreds of warts on udder and teats; milking was so difficult that the value of the animal became questionable. Four treatments each of 10cc of the vaccine were given and resulted in the disappearance of the warts. The condition recurred after a few months but was successfully combated with additional vaccine therapy.

[9] Biberstein, H., and Süssenbach, E. Therapy of Papillomatosis of the Skin of Cattle. *Tierärztl. Rundschau* 37 (1931): 60.

Treatment of Metritis

Silargel[10] is manufactured by the firm v. Heyden, Radebenl-Dresden, Germany. It is a voluminous white powder, almost tasteless and odorless. It is colloidal silicic acid, containing chloride of silver in firm colloidal solution in the finely divided particles for the purpose of bactericidal action. The content of chloride of silver makes it somewhat sensitive to light, turning it bluish on prolonged exposure, without lessening its therapeutical efficiency. When applied in powder form, its main action rests on its power of absorption. Toward corpuscular particles (bacteria) it exhibits great power of adhesion. Among the advantages over charcoal is its ability to absorb about 82% neurin, a resultant of basic metabolic processes which forms especially during putrefaction of the afterbirth. In addition to its absorptive action it also has a powerful oligodynamic metal action which practically kills the adhering pathogenic germs, without irritation to the tissue. The author has used it in over 150 cases of metritis. He insists that the afterbirth be removed gently. If one does not succeed in removing them

[10] Claassen. Silargel in Bovine Obstetrics. *Tierärztl. Rundschau.* 37 (1931): 7.

within 24 hours, the prognosis can still be made favorable if Silargel is prophylactically employed. If removal of the secundinae *in toto* is not possible, at least the major part of the afterbirth is removed from the uterus, which then contracts and regenerates much easier. The area of the inner surface is reduced and the danger lessened. It is important to remove the putrid fluids either by suction or by absorption with tampons. Irrigations are to be avoided. In the later stages, when the hand cannot be passed through the *os uteri,* massage of the uterus per rectum has proved valuable. Following this, Silargel is introduced. The application is the same as with charcoal. From 4 to 8 gelatine capsules, containing 10 to 15 grams of the medicament are distributed to the two uterine horns.

Bacterial Flora of the Equine Eye

The following germs were found in the conjunctivae of horses[11] and were cultivated:

1. Non-pathogenic: *staphylococcus albus, staphylococcus aureus, micrococcus agilis, micrococcus candicus, micrococcus tetragonus, micrococcus catarrhalis* (weakly pathogenic for mice, guinea-pigs and rabbits), *micrococcus conglomeratus; sarcina alba, sarcina conjunctivae; bacillus, mesentericus, bacillus mesentericus multipediculus;* fungi.

2. Pathogenic : *pneumococcus sp.; streptococcus sp.*

The Portals of Infection in Pigs

Histological investigation[12] of cases of open tuberculosis of the tonsils of the pig, of pyogenes infection, erysipelas infection and worm invasion lead the author to the conclusion that the tonsils play an important rôle as portals, especially for tubercle bacteria. Repeated infections of other organs may start from the tonsils. The possibility of lymphomatogenous or hematogenous infections becomes therefore more remote.

---

[11] Marsalsky, K. L. Study of the Microbal Flora of the Normal and Pathological Conjunctivae of Domestic Animals. *Tierärztl. Rundschau* 37 (1931): 24.

[12] Horn, H. Relationship between Microorganisms and the Tonsils of Pigs. *Tierärztl. Rundschau.* 37 (1931): 21.

Clarification Reaction for Bang's Disease[13]

Required for the technic is a suspected serum, *Br. abortus* extract, a 1% NaCl solution, M. T. R. (Meinecke Turbidity Reaction)—lues extract "weak," and Victoria blue. The sera should be perfectly clear, preferably fresh; a not too pronounced hemolysis does not interfere. Addition of carbolic acid has a slight inhibitory action. Important is the application in the active stage. Bacterial extract, as used for complement fixation, is employed as antigen. It is expedient to use an antigen with a high titre, preferably 1 to 2%. For the A. K. R. an amount double the one binding the complement is required. For instance if 1% in the complement fixation, it must be 2% in the A. K. R. The technic of antigen preparation is the usual one. The manner of preservation — whether carbolic acid or chinosol—is immaterial. Since, however, the use of a standardized antigen is of advantage in the interest of comparable results, the bacterial extract "Abortigen" of the "Bacterial Institute of the Berlin Chamber of Agriculture" is recommended. The M. T. R. lues extract "weak" is supplied by the "Adler Drugstore" at Hagen, Westphalia (Germany). For the A. K. R. it is used in proportion 1+14 (1cc M. T. R. extract+ 14cc 1% NaCl sol.). The amount of bacterial extract is calculated for the mixture (15cc in the present test). It is advisable to add the bacterial extract to the NaCl solution in such a manner that the resulting bacterial-extract-sodium-chloride solution does not exceed 14cc. Victoria blue is added in an amount of 0.015 gm. to 50cc of M. T. R. extract. This facilitates the reading. In a positive reaction the Victoria blue combines intimately with the precipitated flakes, leaving the fluid above it clear and colorless. In a negative reaction the fluid appears bluish gray and opalescent.

The test is as follows: Tube No. 1 receives 1cc M. T. R. extract, tube No. 2 receives 0.3cc abortus antigen (it is assumed that the titre of the complement fixation was

[13] Menck, F. The abortus Clarification Reaction (A. K. R.), a New Simple and Accurate Method for the Serum Diagnosis of Abortus Bang. *Berl. Tierärztl. Wchnschr.* 47 (1931): 178-181

1%) + 13.7cc of 1% NaCl solution and is vigorously shaken. Both tubes are now separately incubated in a thermostat or water bath at 56° C. for 15 minutes. After this, the contents of both tubes are slowly mixed together; it is best to pour the content of tube No. 2 into tube No. 1. After 3 or 4 times pouring and mixing, the resulting mixture (15cc) is incubated an additional 3 to 5 minutes in the 56° C. thermostat or 56° C. waterbath. It is now best filtered through paper filter; it appears opaque milky; if Victoria blue has been added, it stains intensely blue. To two tubes containing 0.2cc each of the suspected serum, 1cc of the mixture is added. The tubes are shaken for a short time, and then first put in a 37° C. incubator for 2 to 3 hours and afterward kept at room temperature for 16 to 20 hours. The reading is as follows: +++ very pronounced flocculation, fluid perfectly clear. ++ less vigorous flocculation, fluid imperfectly clear. + weak flocculation, fluid dim, indicating slight clearing. — greenish blue opalescent fluid; after 48 hours there is sometimes a color spot or a haziness at the tip of the tube, but never discoloration. The specifity of this test had been proved by several check experiments. On the basis of 2,793 sera, examined by this method and the tube agglutination test, the author considers the A. K. R. test superior to the agglutination test. It has the added advantage of saving time and labor by the simplicity and rapidity of reading (with experience, it can be read after 1 to 2 hours incubation at room temperature).

Oral Administration of Bacterins[14]

Experiments[14] show that very young mammals may become immunized from feeding them repeatedly with killed bacteria. Their serum becomes capable of agglutinating the treatment antigen. Peroral immunization of young and mature birds has the same effect. Young mammals may likewise be immunized against a later infection with living virulent bacteria. The degree of immunity attained is, as a rule, very low, but the regularity with which this rather weak effect is obtained shows the fundamental effectiveness of the immunization method employed. When instead of the killed bacterial bodies a lysate of the bacteria is employed, in which the antigen is present in dissolved form, rendering it more easy of resorption, then the effect of peroral immunization is much stronger.

Effects of the Calcium Level on Behavior of Cattle[15]

The equi-balance between sympathicus and parasympathicus, which affects the absolute Ca (and K) content of tissue and blood and the relation of blood Ca to tissue Ca (and K), affects likewise sexual events. The equi-balance of the vegetative nervous system is dependent upon hormones. It is known that the hormone activity, especially in the sexual apparatus and in the endocrine glands connected with it, is easily and relatively considerably subject to changes. Considerable ovarian activity and presumably an overtonus of the parasympathicus exists. A displacement of tissue Ca into the blood will therefore result.

The decrease of blood Ca during pregnancy may be explained by the demands of the fetus. But here, too, displacements of the sympathicus—parasympathicus balance are probable. The fact that bulls have more Ca than the cows speaks for a certain preponderance of the sympathicus in male animals. This also expresses itself in the quicker metabolism of the male and in the tendency in the female (at least in humans) toward a greater disposition to fat deposits. The higher Ca level during the summer months can hardly be explained otherwise than by the predominance of the sympathicus. The increase of serum Ca in nymphomania may temporarily at least be considered as a cause of hypo-ophory and hypoparasympathicotony, that is an overtonus of the sympathicus, as an approach to the values of the male sex whose sympathicustonus is stronger than in the female sex. Castration in the male removes the tonic

[14] Dempe, H. Peroral Immunization of Mammals and Birds with Killed Disease Germs. *Zeitschr. f. Hyg. u. Inf.-krankh.* 112 (1931): 80-87.

[15] Frei, W., and Emmerson, M. A. Action of the Sexual Apparatus upon Blood and the Vegetative Nervous System. *Berl. Tierärztl. Wchnschr.* 47 (1931): 161-164.

effect upon the sympathicus, causing the blood Ca to react with a decrease, while the removal of the ovary eliminates the tonic effect upon the parasympathicus and probably raises the tissue Ca level. However, as outlined above, in certain cases of spaying for nymphomania, a decrease of the Ca level may be expected. The functions of the vegetative and animal system are of course closely related to each other. The behavior of calves toward their surrounding is different from that of the cows. The behavior of the animal in heat differs from the one not in heat, of the pregnant from the non-pregnant. The nymphomaniac animal especially exhibits a deranged behavior toward its environment.

Rickets, Tetany and Nymphomania in Cattle

The author[16] contends that performances in cattle breeding not only have been pushed to the limit, but that the high yields have been obtained by forced inbreeding and abnormal nutrition. Diseases, however, have been due not only to high demands but also due to lack of certain properties, essential to the organism for life and proper development.

According to newer investigations, rickets is a disturbance of the calcium metabolism caused by the lack of vitamine D. Osteomalacia may be called rickets of the fully developed bone frame. A special form of rickets is tetany, a phosphorus deficiency, which formerly was considered a disease of the nervous system.

This latter disturbance of the metabolism is frequently seen among young cattle. It is peculiar in so far as in contradistinction to rickets in which the quotient Ca/P increases, the calcium-value of the blood-serum is decreased. Tetany often develops into rickets and it may therefore aptly be termed a preliminary stage of rickets. In certain countries both diseases are seen side by side. They may be termed seasonal diseases because they are mostly seen in the spring, following years with a dry summer.

The most satisfactory treatment proved to be feeding a mineral mixture containing 60% carbonate of lime, 35% phosphate of lime and 5% cattle salt. In addition the cattle received vitamine D in form of the activated ergosterol (viosterol) and cod liver oil. The purpose of the cattle salt is to provide iodine for the body. The amount of mineral mixture given to the rachitic cattle is from 60 to 80 gm.; of the cod liver oil 60 to 80 gm.; viosterol is given in drops, beginning with 15 drops and decreasing the number of drops each day.

The dosage for pigs is 15 to 50 gm. of the mineral mixture, 10 to 15 gm. cod liver oil and 3 to 8 drops viosterol as initial dose; decreasing the latter each day as before. In order to guard against an overdose of viosterol, it is advisable to mix 10cc viosterol (250 drops) with one liter of purest salad oil, then each 5cc (one teaspoonful) will contain 1¼ drop viosterol. It is also advisable to use the smallest amount recommended.

With regard to nymphomania the author is of the opinion that the breed of cattle is not so much responsible for the incidence of the disease as the stabling and the economic conditions. It is rather striking that nymphomania occurs in many places simultaneously with rickets. Of course one may not say that both diseases are etiologically related, but it cannot be denied that for both diseases a common predisposing factor is likely possible. Following this line of thought, the vitamine theory presents itself and it seems possible to connect ovarian diseases and their sequel, nymphomania, etiologically with vitamine deficiency. The antisterility vitamine E which according to newer investigation is said to be closely connected with the ovarian hormone is of special concern in this direction. The significance of vitamine deficiency in sterility has been pointed out repeatedly in the literature and it seems timely to pay increased attention to this matter.

[16] Kust. Contribution to the Knowledge of Rickets and Nymphomania. *Tierärztl. Rundschau* 36 (1930): 741-743; 766-769.

Filter-Passing Properties of Tubercle Bacilli[17]

It has been demonstrated that the granular vegetative forms of the tubercle bacillus, occurring in the sputum of certain individuals are capable of passing Berkfeld and Chamberland filters and may be demonstrated microscopically. Apparently there are two kinds of granules in the tuberculous sputum: a larger one, spore shaped, which seems to germinate directly, and a smaller one. The formation of granules and the filtrability connected with it are a characteristic not only of tubercle bacteria but also of the visible forms of filtrable viruses and numerous bacteria. It could also (for the first time) be demonstrated that granular vegetative forms occur in the actinomyces fungus, a near relative of the tubercle bacillus. In analogy to the ray fungus it may be assumed that the small granules of the tubercle bacillus form symplasms and then, successively, develop by sprouts. This assumption seems to be substantiated by the finding of mass- (nest-) formation in the organs of guinea pigs sprayed with the filtrate of tuberculous sputum. The abnormal granules and other forms occurring among bacteria under unfavorable external conditions are termed lasting modifications. In contradistinction to the common form, usually described in textbooks, these are not generally known. The granular forms of bacteria are not to be confused with filtrable viruses. They have in common with them the filtrability only.

Vitamine A Deficiency in Cattle[18]

The disease has been observed since 1923. Possibly it existed before that time, but due to complications with other diseases it was not recognized as deficiency disease. The soil in the affected region consists of variegated sandstone and is very deficient in calcium. Occasionally outcroppings of shelly limestone occur. The meadows are generally poor. Many meadows are swampy. The feed consisted of hay, straw and roots. The morbidity is highest during the winter months and less in spring and summer.

The first clinical symptoms occur on the skin. The skin lesions start as a rule on the withers, in some cases on the dorsal part of the neck or, rarely immediately behind the scapula. In the beginning they are circumscribed roundish areas, the size of a silver dollar, sharply marked off from the surrounding tissue. The hairs are easily pulled out and the skin becomes bald. Later on exfoliation sets in, giving the skin the appearance of being covered with bran. In cattle with long hair, the hairs become matted and protrude over the surface. The diseased skin feels thick and firm, later it becomes folded and fissured and loses its pliability. Still later the skin lesions spread over the entire surface of the body.

The appetite and general condition of these animals is not disturbed in the beginning. With the spread of the skin-lesions the appetite decreases, first without any noticeable influence upon the general condition. In the course of the disease the animals assume a languid attitude, the ears droop, a watery discharge from the eyelids appears, saliva dribbles from the corners of the mouth in skeins. At this stage the clinical picture closely resembles malignant catarrhal fever. Fever, however, is absent. Likewise, the histological examination of the brain is negative.

Temporarily the severe disturbances of the general condition may disappear, the appetite will pick up, but with the progressive emaciation anexoria takes place again until the animals are reduced to skin and bones.

The pulse is frequently increased (70 to 80), but the body temperature never. Neither is the respiration accelerated or labored. Examination of the digestive, urinary and sexual apparatus reveals nothing extraordinary. Sometimes, especially with the sudden onset of the disease, motility of the rumen and intestines is suppressed. Calves and heifers frequently show a severe diarrhea with normal intestinal motility. The animals soon tire from exercise. Increased sensibility or irritability is not observed. Peculiar psychical disturbances occur, especially during protracted cases in young animals. These

[17] Lucksch, F. The Filtrability of Tubercle Bacteria and Other Bacteria *Zentralbl. f. Bakt.* etc. Abt 1, Orig. 117 (1930): 1-15.

[18] Gminder, A. A. peculiar Avitaminosis of Cattle in Wuerttemberg. *Archiv f. Tierheilk.* 63 (1931): 275-282.

animals exhibit a dull facial expression and an indifference to their surroundings. The palpable lymph nodules are not enlarged. The blood examination shows a decrease of the red blood cells but no other changes. The visible mucous membranes are first pink but in very emaciated cattle they become pale.

Typical lesions occur in the mouth and nose. In severely affected animals some of the papillae of the cheek appear dark red. On the tongue and the hard palate appear yellowish raised areas with pink borders, of the size of a 25-cent piece. On the toothless section of the mouth and laterally from the outer incisors yellowish to yellowish-brown layers are visible. Similar yellowish layers likewise adhere, often loosely, to the apex of the tongue. When complicated with pyogenic infection, nodules, varying in size between a lintel and a bean, are seen on the mucosa of the undersurface of the tongue. Nodules as large as a walnut may be felt in the cheeks.

Complete recovery was brought by feeding cod liver oil. It is therefore concluded that the lack of vitamine A and D is playing an important rôle in the etiology of the disease. Improvement, but not complete recovery, followed the use of apomorphine. In addition, the feeding of concentrates and treating the fields with lime and related fertilizers was recommended.

The Production of Vomiting in Cattle[19]

Powdered root of *Veratrum album*, given with sodium bicarbonate, causes vomiting more frequently than when given with sodium sulphate. The explanation for this is that sodium carbonate causes a more powerful contraction of the esophageal groove than sodium sulphate. Thus when given with sodium bicarbonate, the chances that the powdered veratrum root will reach the abomasum are greater than when given with sodium sulphate. In young cattle, the combination of powdered root of *Veratrum album* with milk or buttermilk will probably also cause vomiting. In order to assure oneself that the veratrum will not be vomited, it should be given with water or in a thin mucilagenous fluid, causing the drug to be deposited in the reticulum and gradually in the abomasum. Powdered root of *Veratrum album* is conceded to be the rumination-stimulating drug *par excellence*.

It has been shown that vomiting depends on the same mechanism as rumination. It is therefore obvious that a slight vomitus-causing stimulus will excite not vomitus but rumination. The dose of powdered root of *Veratrum album* for the stimulation of rumination in cattle is 10 to 15 gm. (given with water).

In a large bull, 3 gm. of powdered root of *Veratrum album*, given with sodium bicarbonate, produced vomiting. Care should be taken that the drug is not too old and that it has been kept dry. Long storage and especially humidity reduces its activity. The action of powdered veratrum root is a combined one, that is, a local stimulus upon the mucosa of the abomasum and a stimulus from the resorption of the alkaloid. As a general rule, vomiting is a function which causes much exertion and undesirable fatigue of the patient. Besides, powdered veratrum root irritates the mucosa of the abomasum in an undesirable manner and the appetite is diminished for several hours afterward. In diseases of the abomasum, which, it is presumed, are far more common than is known at present, vomitus due to powdered veratrum root is contra-indicated. One should cause sick cattle to vomit then only when a certain effect is desired, for instance, to relieve impaction of the rumen. Unfortunately one can be assured of producing vomitus with veratrum in young cattle only. In older cattle, more dependence can be placed by giving this drug combined with sodium sulphate in heavy concentrations, 100 gm. to 300cc water, or, still better, with sodium chloride in equal concentration. The fluids should be poured into the mouth slowly in order to cause the esophageal reflex to function.

Tartar emetic has been greatly overestimated as a stimulant for rumination. Under no circumstances does it produce vomitus. Repeated large doses (with water) cause diarrhea from enteritis but no vomitus.

[19]Wester, J. Vomiting in Ruminants. *Berl. Tierärztl. Wchnschr.* 47 (1931): 337-340.